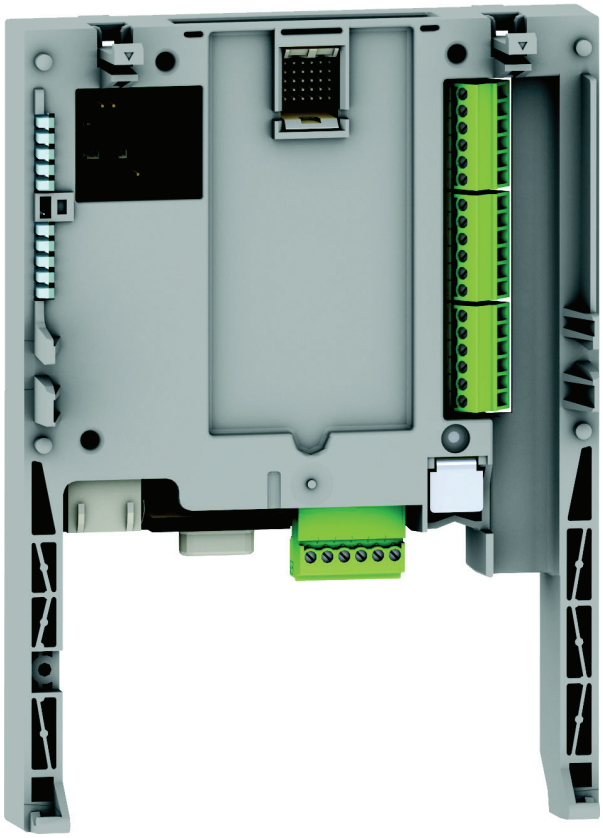
Altivar® 61

User Manual
30072-452-30
Retain for future use

Water Solution, Multi-pump Control Card

VW3A3503



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Hazard Categories and Special Symbols

The following symbols and special messages may appear in this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

A lightning bolt or ANSI man symbol in a “Danger” or “Warning” safety label on the equipment indicates an electrical hazard which, as indicated below, can or will result in personal injury if the instructions are not followed.

The exclamation point symbol in a safety message in a manual indicates potential personal injury hazards. Obey all safety messages introduced by this symbol to avoid possible injury or death.

Symbol	Name
	Lightning Bolt
	ANSI Man
	Exclamation Point

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

PRODUCT SUPPORT

For support and assistance, contact the Product Support Group. The Product Support Group is staffed from 8:00 am until 6:00 pm Eastern time to assist with product selection, start-up, and diagnosis of product or application problems. Emergency phone support is available 24 hours a day, 365 days a year.

Toll free: 888-SquareD (888-778-2733)
E-Mail: drive.products.support@us.schneider-electric.com
Fax: 919-217-6508

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Before you Begin

Read and follow these precautions before performing any procedure with the drive controller or the Water Solution, Multi-pump Control card.

⚠ DANGER

HAZARDOUS VOLTAGE

- Read and understand this manual before installing or operating the Water Solution, Multi-pump Control card. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive controller, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/– or across the DC bus capacitors.
- Before servicing the drive controller:
  - Disconnect all power, including external control power that may be present.
  - Place a “DO NOT TURN ON” label on all power disconnects.
  - Lock all power disconnects in the open position.
  - WAIT 15 MINUTES to allow the DC bus capacitors to discharge. Then follow the DC Bus Voltage Measurement Procedure on page 6 to verify that the DC voltage is less than 45 V. The drive LED is not an indicator of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the drive controller.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

Test and ensure that any changes made to the parameter settings do not present any danger to personnel and equipment during drive operation.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

DAMAGED DRIVE CONTROLLER EQUIPMENT

Do not operate or install any drive controller that appears damaged.

Failure to follow this instruction can result in death, serious injury, or additional equipment damage.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.[1]
- Each implementation of a Water Solution, Multi-pump Control card must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow this instruction can result in death, serious injury, or additional equipment damage.

1. For additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.”

DC Bus Voltage Measurement Procedure

Before working on the drive controller, turn it off and wait 15 minutes to allow the DC bus to discharge. Then measure the DC bus voltage.

Measuring the DC bus voltage

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Read and understand the instructions on page 5 before performing this procedure.

Failure to follow this instruction will result in death or serious injury.

The DC bus voltage can exceed 1,000 V ⎓. Use a properly rated voltage-sensing device when performing this procedure. To measure the DC bus voltage:

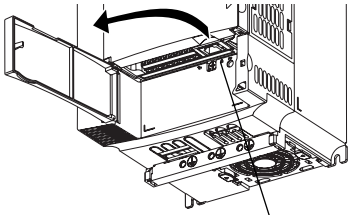
1 Disconnect the drive controller power supply.

2 Wait 15 minutes to allow the DC bus to discharge.

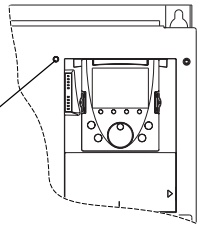
3 Measure the voltage of the DC bus between the PA/+ and PC/– terminals to ensure that the voltage is less than 45 V ⎓.

4 If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive controller.

ATV61H 075M3 to D15M3X and ATV61H 075N4 to D18N4



ATV61H D18M3X to D45M3X and ATV61H D22N4 to D75N4

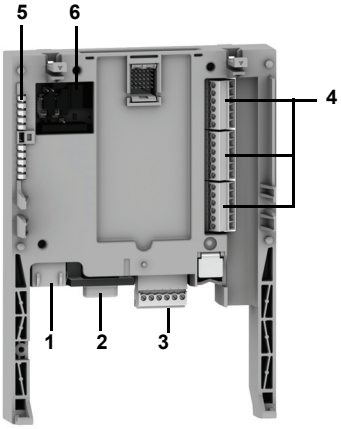


Red LED indicating that the DC bus is turned on. The drive controller LEDs are not indicators of the absence of DC bus voltage.

Description

Parts Descriptions

Figure 1



1 RJ45
Connection to the PC is via a cable and an RS 232/RS 485 converter included in the PowerSuite for PC connection kit, VW3 A8 106

2 Not used.

3 Connector with removable screw terminals, 6 contacts at intervals of 3.81 mm for the 24 V ⎓ power supply, and 4 logic inputs

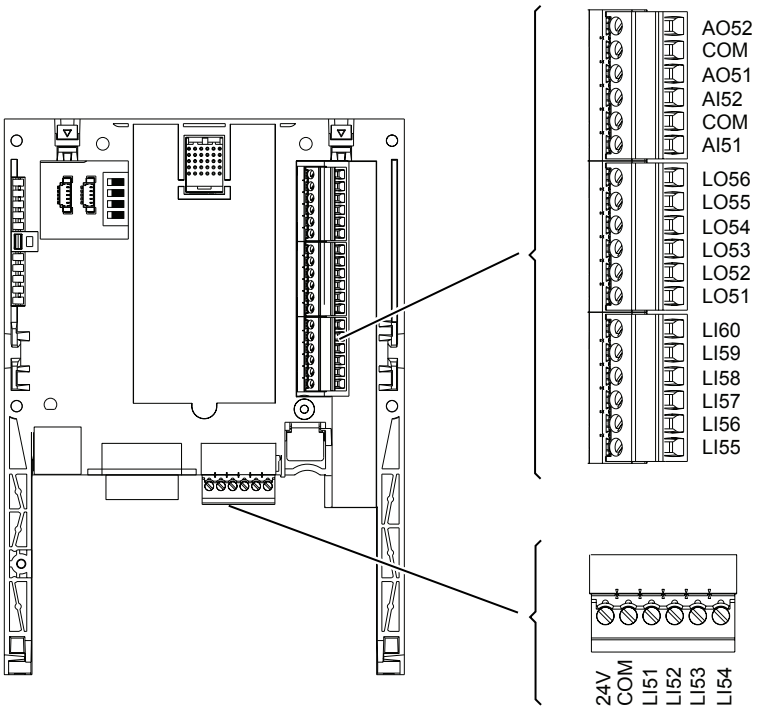
4 3 connectors with removable screw terminals, 6 contacts at intervals of 3.81 mm for 6 logic inputs, 6 logic outputs, 2 analog inputs, 2 analog outputs, and 2 commons

5 5 LEDs, comprising:
- 1 to indicate the presence of the 24 V ⎓ power supply
- 1 to indicate a program execution error
- 2 not used
- 1 controlled by the application program

6 Block of 4 configuration switches

Description of Terminals

Figure 2



Terminal	Function
24 V	Power supply for the Water Solution, Multi-pump card, logic outputs, and analog outputs. Depending on the your setup, if the current consumption meets the criteria shown in the Electrical characteristics table on page 9, the Water Solution, Multi-pump card can be powered by the 24 V ⎓ power supply in the drive controller. If you are using an external power supply: • The Water Solution, Multi-pump card should preferably be turned on before the drive controller. However, the Water Solution, Multi-pump card must be turned on no more than 2 s after the drive controller is turned on. Failure to follow this instruction locks the drive controller in card error mode (ILF). This error cannot be reset, and the only way to acknowledge it is to turn off the drive controller. • Catalog number for a Telemecanique power supply (24 V ⎓, 2 A): ABL7 RE 24 02.
COM	Common ground and electrical 0 V of the Water Solution, Multi-pump card power supply, logic inputs (LI●●), logic outputs (LO●●), analog inputs (AI●●), and analog outputs (AO●●) This ground and electrical 0 V are common with the drive controller ground and electrical 0 V. There is therefore no point in connecting this terminal to the 0 V terminal on the drive control terminals.
LI51 to LI60	24 V ⎓ logic inputs
LO51 to LO56	24 V ⎓ logic outputs
AI51 and AI52	0–20 mA analog inputs
AO51 and AO52	0–20 mA analog outputs

Characteristics

Electrical Characteristics

Power	Voltage	**V**	24 ⎓ (minimum 19, maximum 30)
Current consumption	Maximum	**A**	2
	No-load	**mA**	80
	Using logic output	**mA**	200 maximum *(1)*
Analog inputs (1)	AI51, AI52 COM		2 current analog inputs 0–20 mA, impedance 250 Ω Resolution: 10 bits Accuracy: ± 1 % for a temperature variation of 60 °C Linearity: ± 0.2 % of the maximum value Common point for all the card I/O *(2)*
Analog outputs	AO51, AO52 COM		2 current analog outputs 0–20 mA, impedance 500 Ω Resolution: 10 bits Accuracy: ± 1 % for a temperature variation of 60 °C Linearity: ± 0.2 % of the maximum value Common point for all the card I/O *(2)*
Logic inputs (2)	LI51…LI60 COM		10 logic inputs, 2 of which can be used for 2 counters, or 4 of which can be used for 2 incremental encoders Impedance 4.4 kΩ Maximum voltage: 30 V ⎓ Switching thresholds: State 0 if ⩽ 5 V or logic input not wired State 1 if ⩾ 11 V Common point for all the card I/O *(2)*
Logic outputs	LO51…LO56 COM		Six 24 V ⎓ logic outputs, positive logic open collector type (source), compatible with level 1 PLC, standard IEC 65A-68 Maximum switching voltage: 30 V Maximum current: 200 mA Common point for all the card I/O *(2)*
I/O connection	Type of contact		Screw, at intervals of 3.81 mm
	Maximum wire	**mm^2**	1.5 (AWG 16)
	Tightening torque	**Nm**	0.25 (0.18 lb-ft)
Lithium battery	Life		8 years approx.

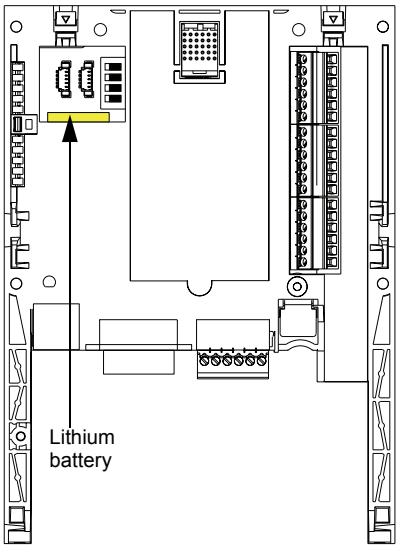
(1) If the total current consumption does not exceed 200 mA, this card can be powered by the drive controller. Otherwise, an external 24 V ⎓ power supply must be used.
(2) This common point is also the drive controller 0 V (COM).

Note: When the VW3 A3 503 Water Solution, Multi-pump card is installed, the analog inputs may be configured for 4-20 mA in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type] and [<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]**. Please See “[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [CONFIG] ~”, page 85.

Data Backup Battery

The Water Solution, Multi-pump card has a non-volatile RAM (NVRAM) for storing variable values. A lithium battery is mounted on the non-volatile RAM to prevent the data from being lost when the card is turned off.

Figure 3



When installing the Water Solution, Multi-pump card in the drive controller, make sure that this battery is present. It is a rectangular block clipped onto the non-volatile RAM. See Figure 3.

The battery life is approximately 8 years when turned off.

The battery has a realtime clock for timestamping.

The date and time on the clock are checked and set from **[DATE/TIME SETTINGS]** at the end of the menu **[1.14 - WATER SOLUT.]**.

The date and time need to be set on receipt of the Water Solution, Multi-pump card, or after replacing its lithium battery.

The lithium battery must only be replaced when the drive controller and the Water Solution, Multi-pump card are turned off. During this operation, the data saved in the NVRAM (4 Kwords) is lost.

☞ Save the configuration with PowerSuite v2.4 (minimum) before removing the battery.

Important:
Batteries are not available as spare parts due to problems of storage over time. If you need to replace a battery, order TIMEKEEPER SNAPHAT M4T28-BR12SH1 (48mAh).

Caution

NVRAM BATTERY REPLACEMENT

Save the configuration with PowerSuite (v2.4 minimum) before removing the battery.

Failure to follow this instruction can result in injury or equipment damage.

Introduction to Water Solution Program

This program provides a full-featured control algorithm for a constant pressure pumping system consisting of up to four pumps. The variable speed pump is controlled by the Water Solution, Multi-pump card. The system can support up to three additional external pumps, either direct on line or, preferably, under soft starter control. One of the external pumps can be set up as a jockey/priming pump.

The Water Solution, Multi-pump card determines how many external pumps need to be operating for the present demand, and operates the variable speed pump at a variable speed to make up the demand requirement.

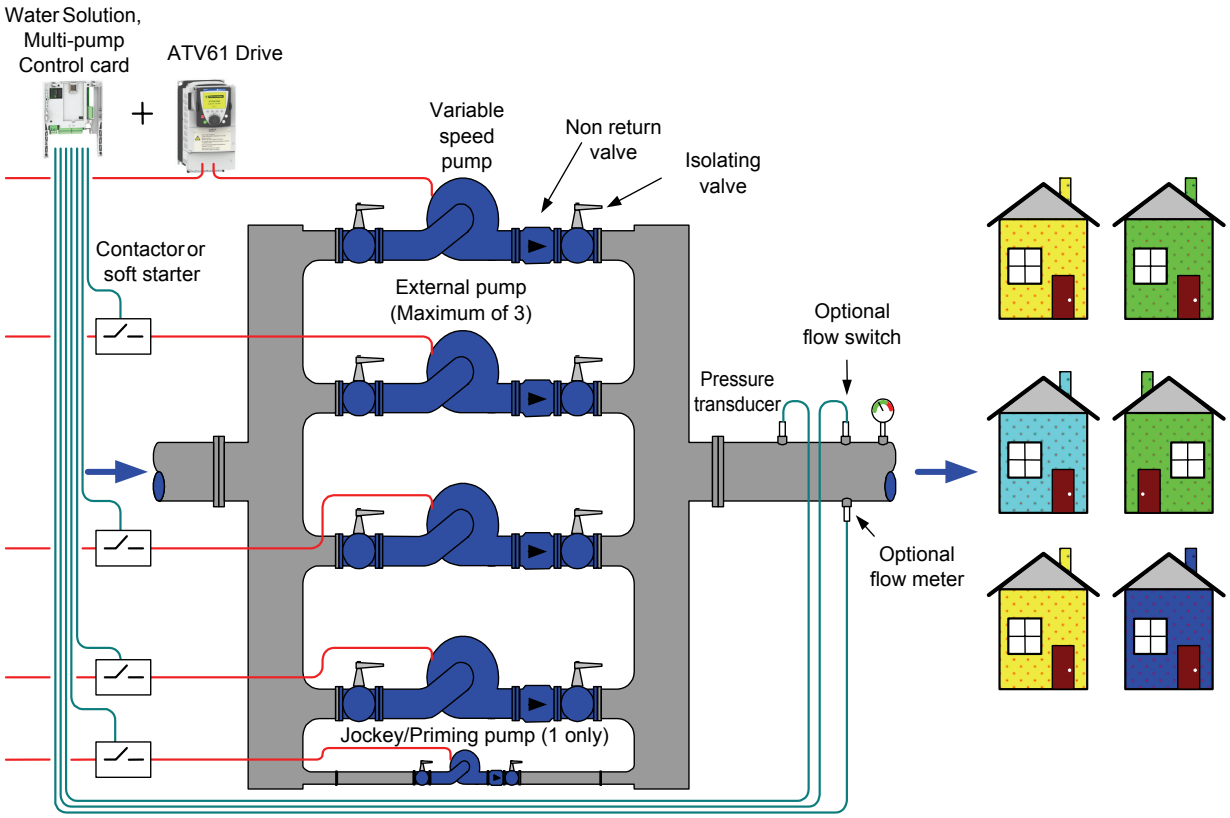
The control algorithm provides a PID function for the variable speed pump reference. The pressure setpoint can either be entered through the Water Solution, Multi-pump card display, or can be sourced from one of the analog inputs. The pressure feedback is connected to one of the analog inputs.

Under normal operating conditions, the control algorithm responds to an increase in demand by initially increasing the speed of the variable speed pump. If the pump is unable to fulfil the demand and has already reached full capacity, the control algorithm switches in one of the external pumps. The variable speed pump will then decrease its speed, as it shares with the external pump to take up the demand.

The control algorithm responds to a decrease in demand by initially decreasing the speed of the variable speed pump. If the demand decreases further, the control algorithm will switch out one of the external pumps. The variable speed pump will then increase its speed to take up the demand.

The diagram below describes a typical variable pump system layout.

Figure 4



Water Solution Program Features Overview

There are three modes of operation for the Water Solution, Multi-pump card:

- **Protected Manual Mode** is selected by closing digital input CI_LI51. When in Protected Manual mode, the Water Solution, Multi-pump card will run at the manual speed reference. All pump related sensing algorithms are active and may stop the pump (for example, High Pressure, Cycling, etc.). The status displays **[PRO MAN]** (Pmm) while in Protected Manual Mode.
- **Override Manual Mode** is selected by closing digital input CI_LI52. When in Override Manual mode, the Water Solution, Multi-pump card will run at the manual speed reference, but no pump related sensing algorithms are active. It is the operator's responsibility to ensure that the pump and installation are not operated outside of the normal operating conditions. Typically, the Override Manual mode is used to test motor rotation without the pump related sensing algorithms interfering. The status displays **[OVER MAN]** (Omm) while in Override Manual mode.
- **Pump Mode**. The digital inputs for all three modes are mutually exclusive. Only CI_LI51 or CI_LI52 or CI_LI57 may be active at any time or the system will be disabled. When not in Manual mode, the Water Solution, Multi-pump card will be in Pump mode when digital input CI_LI57 is closed. When in Pump mode, the Start and Stop commands and the speed reference are generated by the Water Solution control algorithm.

The following features are available in the Water Solution, Multi-pump card:

Duty Sharing (see page 53)

Duty sharing provides control for up to three external pumps in a variable speed pump control system for constant pressure pumping.

The control algorithm responds to an increase in demand by initially increasing the speed of the variable speed pump. If the variable speed pump is unable to fulfil the demand and has already reached full capacity, the control algorithm will switch in one of the external pumps.

If Duty Sharing is disabled, under increasing demand conditions the external pumps will be turned on in numerically increasing order. Under decreasing demand conditions, the external pumps will be turned off in numerically decreasing order. This means external pump 1 turns on first and off last. However, an external pump that is in a fault state (via the digital input) will be skipped.

If Duty Sharing is enabled, then the external pumps will be selected based on their Run Time counters. Under increasing demand, the external pumps will be selected in order of the lowest Run Time counters. Under decreasing demand, the external pumps are progressively switched off in order of the highest Run Time counters. This means the least-used external pump turns on first and turns off last. However, an external pump that is in a fault state (via the digital input) will be skipped.

General Error Segregation (see page 39)

The Water Solution program will respond to a detected fault condition in one of three ways, determined by the nature of the error.

1 Drive detected fault. This is a standard detected fault. If a drive detected fault occurs, the system will switch off all external pumps and ramp the variable speed pump down before stopping. Consult the relevant drive controller manual for further information.

2 Resettable system fault. This is a pump system related fault that is expected to be cleared if the pump system shuts down temporarily. Determined by the setup, resettable system faults can include a high pressure detected on the pressure feedback (analog input), a loss of feedback signal, a pump cavitation condition, or a flow switch activation while at high speed, all of which will result in the pump tripping. A relevant message will be displayed, and additional help messages can be accessed by pressing key F1 (help). If configured in this way, the system will automatically reset a certain number of times for the individual resettable system faults.

3 Non-resettable system fault. This is a pump system fault that is considered too serious to allow the pump to continue operating. Short-cycling the pump (starting too often in a short period of time), activation of the low water digital input, or minimum pressure detection will all result in the pump system tripping and remaining off until reset. A relevant message will be displayed, and additional help messages can be accessed by pressing key F1 (help).

External Pump Control - increasing demand (staging)(see page 53)

The variable speed pump responds to an increase in demand by initially increasing speed. If the demand is too great for the variable speed pump to fulfil, the Water Solution, Multi-pump Controller card will start an external pump.

A high demand condition can be detected by:

- High variable pump speed
- High variable pump speed + delay
- Increasing system error (system error = setpoint - feedback)
- Increasing system error + delay
- High variable pump speed and increasing system error
- High variable pump speed and increasing system error + delay

This allows the response mode to be set up to suit the system requirements.

External Pump Control - decreasing demand (destaging)(see page 57)

The Water Solution, Multi-pump Controller card responds to a decrease in demand by initially decreasing speed. If the demand is too low for the number of pumps running, the card will stop an external pump.

A low demand condition can be detected by either:

- Low variable pump speed
- Low variable pump speed + delay
- Decreasing (or negative) system error (over pressure)
- Decreasing system error + delay
- Low variable pump speed and decreasing system error
- Low variable pump speed and decreasing system error + delay

This allows the response mode to be set up to suit the system requirements.

In some cases, a decreasing demand condition may be required to turn the variable speed pump off while one or more external speed pumps are still running. Due to the flexibility of the Water Solution system, it is possible to configure the variable speed pump to turn off due to the No Demand permissives while the external pumps continue to run.

No Demand Shutdown

During a period of decreasing demand, the control algorithm will turn off the external pumps and the variable speed pump will decrease its speed. When a No Demand condition is detected, the variable speed pump will automatically turn off, and the pump system will remain in the no demand state.

A no demand condition can be detected by any combination of:

- Low variable pump speed
- Low variable speed pump current
- Low flow rate (flow meter)
- Low flow rate (flow switch)
- Advanced sleep detection

The delay between the time that a No Demand condition is detected and the time that the variable speed pump automatically turns off and the pump system enters the state is adjustable.

PID Bypass Speeds (see page 54 and page 58)

During pump switching, better performance may be achieved if PID control is bypassed, rather than relying on the PID response alone to adjust the variable speed pump to accommodate for the increased or decreased flow capacity. Two bypass speeds are available:

1. Stage Bypass - When the Water Solution, Multi-pump card requests an external pump to start, the Stage Bypass Speed is used to decrease the variable speed pump to accommodate for the increased flow capacity of the additional pump.

2. Destage Bypass - When the Water Solution, Multi-pump card requests an external pump to stop, the Destage Bypass Speed is used to increase the variable speed pump to accommodate for the decreased flow capacity.

The Water Solution, Multi-pump card's status will display **[BYP]** (BYP) while any of the bypass speeds are active.

Setpoint Ramp (see page 26)

On initial starting or after a period of no demand, the feedback pressure may be below the setpoint pressure. To avoid the effects of the resultant feedback error on the PID, the Setpoint Ramp algorithm overrides the pressure setpoint and applies a derived setpoint to the PID controller. The derived setpoint commences at the present feedback pressure (resulting in no error being applied to the PID controller) and ramps up to the desired setpoint. The rate at which the setpoint ramp occurs is adjustable.

The setpoint ramp is considered complete if the system error reduces to 0, (system error = setpoint - feedback). That is, the system has started and the feedback pressure has risen to the setpoint pressure.

The Water Solution, Multi-pump card's status screen will indicate **[SET RAMP]** (RAMP) during a Setpoint ramp.

Pulse Flow Meter Input

The Water Solution, Multi-pump card will accept direct connection from a pulse emitter type flow meter. This pulse signal is directly converted into a flow rate within the Water Solution software.

The Water Solution, Multi-pump card will also accept a flow signal via the analog inputs if required.

Water Solution Program Features Overview

Flow Limiting (see page 47)

When the flow must be restricted to a particular level, the Flow Limit algorithm may be used. If the flow reaches the Flow Limit, the motor speed is ramped down. Once the flow is below the Flow Limit, the motor speed is held at its present value (or allowed to decrease if required). The Flow Limit algorithm will release the motor speed once the flow has dropped below the Flow Limit Reset. The rate at which the motor speed is ramped down is adjustable.
While the Flow Limit is active, the status will display **[Q LIMIT]** (QLT).

Pipe Fill (see page 25)

On initial start up, it is possible that there is minimal or no fluid in the downstream pipe. To avoid the effects of the resultant feedback error on the PID, the Pipe Fill algorithm may override the PID when the variable speed pump starts. The variable speed pump will run at a preset speed until the system pressure increases to indicate the presence of fluid in the pipe.

The Water Solution, Multi-pump card's status will display as **[PIPE FILL]** (FILL) during while the Pipe Fill is active.

Multiple Acceleration and Deceleration Rates

The system uses different acceleration and deceleration rates determined by the status. One rate of acceleration and one rate of deceleration can be configured for times when the speed is below minimum (LSP). This is used to meet manufacturer specifications for pumps that require a minimum speed for cooling. There are also rates used when the system is under PID control which allows optimum performance. A third deceleration rate is used when the flow limit algorithm is active, and a fourth when a system fault condition is present.

Automatic Turn-On Turn-Off (Set Time Pumping)

The pump system can be configured to run automatically based on time. The system can be configured to start at a user-specified time and turn off at a user-specified time. This allows for such things as night time irrigation.

Pressure Display in Engineering Units

The pressure feedback signal can be displayed as a percentage value, or in the following engineering units:

- kPa
- bar
- psi

Flow (friction loss) Compensation (see page 69)

If a flow meter is installed, the flow compensation algorithm may be used to automatically adjust the setpoint pressure to compensate for losses due to the increasing flow. The friction loss that will occur may be determined empirically, or the pressure drop can be measured at the outlet under a known flow condition.

The flow compensation algorithm uses this value to determine the compensation to be applied to the setpoint pressure at all flow rates.

This compensation algorithm is suited for cold water piping systems, but will also generally provide acceptable compensation on most water systems.

Alternatively a fixed compensation may be used where a set amount of compensation is applied relative to the number of external pumps running, and the dynamic speed of the variable speed pump sets the proportion of variable speed pump compensation.

System Shutdown Options

The variable speed pump stop type can be selected as either ramp stop or free wheel stop. If a system fault condition is present and ramp stop is chosen, the system will ramp down at the rate set by [FAULT RAMP] and then trip displaying the relevant message. If the system fault is resettable, the system may restart after a time delay if so configured.

When the variable speed pump turns off under No Demand conditions, the selected destage mode will determine the response of the external pumps. If the variable speed pump is a condition of destaging, then the external pumps will sequentially shutdown at the destage delay intervals. If the variable speed pump is not required for destaging, the external pumps will remain running until a decreasing demand causes an over-pressure condition.

Water Solution Program Features Overview

High Pressure Detection (see page 34)

There are two High Pressure detection mechanisms.

1 If enabled or auto reset is selected for high pressure, then DRIVE_LI3 is activated as a high pressure switch. This input accepts a normally closed input. If this input is then not active for 1 second, the drive controller will trip. This system fault will not auto reset.

2 If enabled or auto reset is selected for high pressure, then the analog pressure feedback signal can be used to detect a high pressure condition. If a high pressure is detected and the digital detection level hasn't been exceeded (DRIVE_LI3 is still present), the system will shut down (including all external pumps). If so configured, the system will auto reset.

Note this will not protect against a high pressure condition if the feedback signal is interrupted or goes open circuit.

No Flow Detection (see page 34)

The system can be configured in many ways to detect low flow. Digital detection can be used as well as, or instead of, a flow meter if one is installed. This detection can be set to operate during pipe fill or not. If low flow is detected, the system will shut down and trip. If so configured the system will auto reset.

Minimum Pressure (High Flow) Detection (see page 41)

If enabled, the system will trip if a minimum pressure cannot be met when the variable speed pump is running at a speed greater than the one set. If minimum pressure (possible burst pipe) is sensed, the system will stop and trip. This system fault will not auto reset.

Cavitation Detection (see page 34)

The Water Solution, Multi-pump card has a cavitation detection algorithm. Cavitation is detected by high pump speed and low motor current. When cavitation is detected, the system will stop and trip displaying **[CAVITATION]**. If so configured, the system will auto reset.

Low Level Lockout (Low Water) Detection

If enabled, the system will stop and trip if digital input CI_LI60 is inactive for longer than a user adjustable time. This feature is typically used for low well level or low supply tank level.

During this period the status will display **[LOCK OUT]** (LOCK).

Cycling Detection (see page 41)

Cycle detection is designed to detect the condition where the system is unable to maintain pressure in the **[READY]** state and the variable speed pump immediately restarts (i.e., an inoperable NRV). A start is considered to have occurred every time the pump accelerates from zero speed, and the Cycle counter is incremented on each start. If cycling is sensed, the system will stop and trip displaying **[CYCLING]**. This system fault will not auto reset.

Jockey Pump (see page 60)

During a period of no demand when the system has been in the **[SLEEP]** (SLP) state, a very low demand may cause the pump to cycle. The jockey pump function is used to supply these very low demand requirements. Unless the pump is already running, the jockey pump is turned on when the feedback pressure drops below the Jockey On Pressure. The jockey pump will turn off if the feedback pressure increases above the Jockey Off Pressure, or if the variable speed pump starts.

The status will display **[JOCKEY ON]** (JKY) while the Jockey pump is on.

Priming Pump

The Jockey relay can be configured for a priming pump. In this situation, the relay will switch on whenever demand is present.
The status will display **[JOCKEY ON]** (JKY) while the Jockey pump is on and the drive controller is off.

Night and Day (see page 65)

This feature is used when no jockey pump is installed, but instances of small demand are expected during the night. The feature uses the variable speed pump at a fixed speed to meet small demands. This feature will automatically disable itself if a substantial demand is sensed via repeated starts in a short period of time or a lack of response in system pressure.

☞ Note that the internal clock does not automatically switch to daylight saving time.

Water Solution Program Features Overview

Inlet Detection (see page 73)

This feature requires a pressure transducer to be installed on the suction side of the variable speed pump, as well as on the discharge. The applied setpoint is reduced when the suction pressure falls. This feature is typically used where the variable speed pump is operating as a pressure booster.

Anti Jam (see page 76)

This feature is used to clear the pump impeller of any built-up product. This is achieved by quickly cycling the pump direction. There are several means to trigger the **[Anti Jam]** function.

Frost Detection (see page 81)

This feature is used to help protect crops susceptible to frost damage by either activating a relay or by starting the system and using a custom PID setpoint, or both.

System IO Configuration

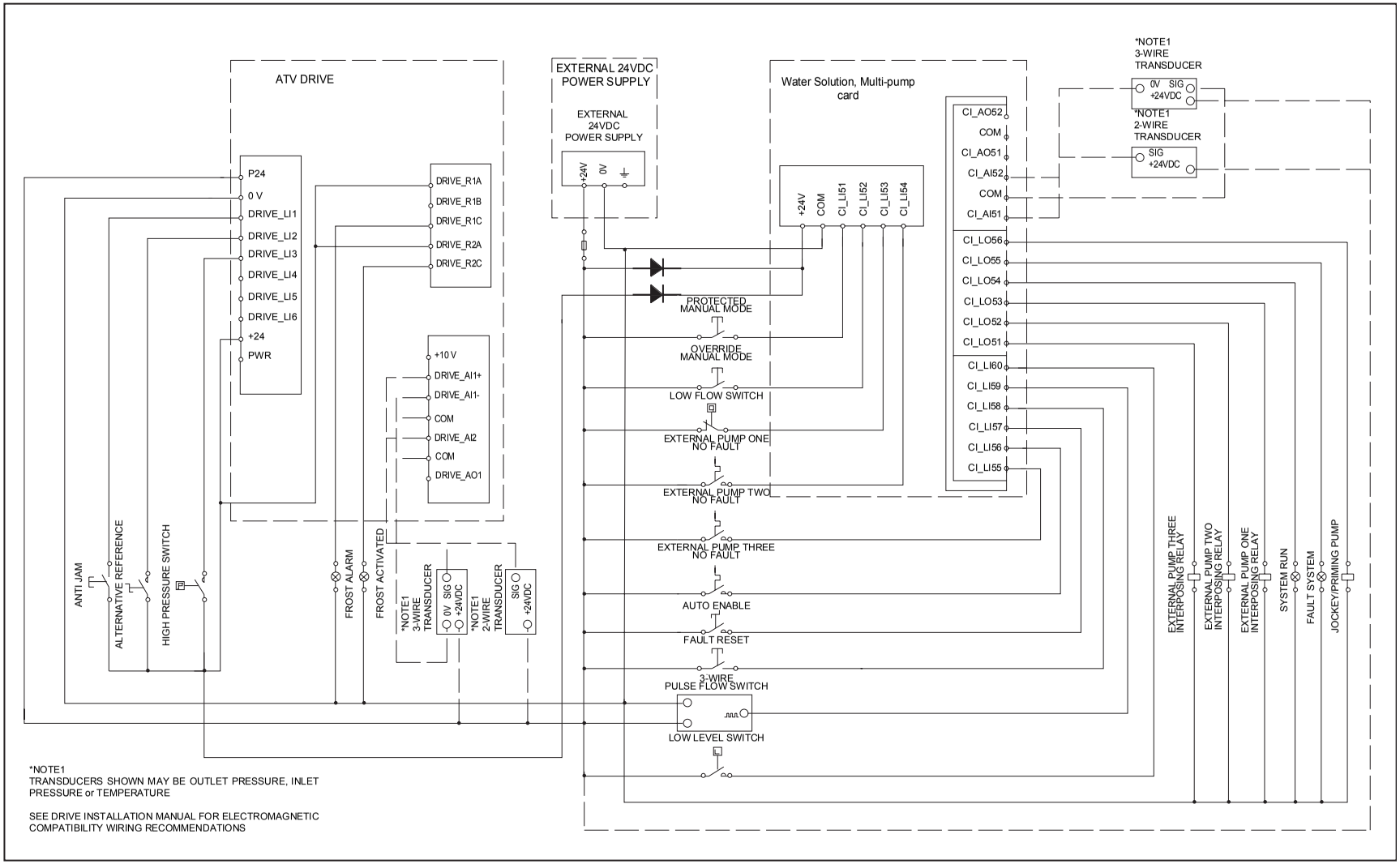
The tables below describe the system IO configuration.

	Water Solution, Multi-pump card
CI_LI51	Protected Manual Mode
CI_LI52	Override Manual Mode
CI_LI53	Low Flow Switch
CI_LI54	External Pump One, no detected fault
CI_LI55	External Pump Two, no detected fault
CI_LI56	External Pump Three, no detected fault
CI_LI57	Auto Enable
CI_LI58	System Fault Reset
CI_LI59	Pulse Flow Switch
CI_LI60	Low Level Lockout
CI_LO51	External Pump One Run
CI_LO52	External Pump Two Run
CI_LO53	External Pump Three Run
CI_LO54	System Run
CI_LO55	System Fault (1)
CI_LO56	Jockey Pump/Priming Pump Run
CI_AI51	User assignable
CI_AI52	User assignable
CI_AO51	User assignable
CI_AO52	User assignable
	ATV61
DRIVE_LI1	Anti Jam Trigger
DRIVE_LI2	Alt Reference
DRIVE_LI3	High Pressure
DRIVE_LI4	Unused
DRIVE_LI5	Unused
DRIVE_LI6	Unused
DRIVE_R1	Frost Alarm
DRIVE_R2	Frost Activated
DRIVE_AI1	User assignable
DRIVE_AI2	User assignable

(1) System fault corresponds to parametrized faults in menus "[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [RESET FLT] ~", page 34 and "[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [NRESET FTL] ~", page 41.

Water Solution Electrical Schematic

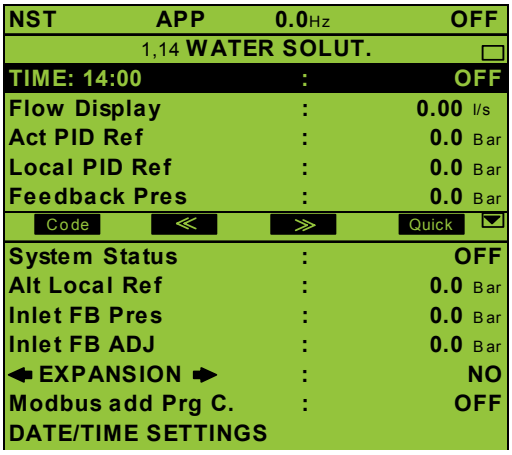
Figure 5: Water Solution, Multi-pump card Electrical Schematic



Water Solution Screen Navigation

To configure the Water Solution, Multi-pump card, navigate to the custom screens as follows:

Select **[1.14 WATER SOLUT.]** and press enter. You will see the following screen:



[Flow Display]: (Flow Display)

Minimum	0.0
Maximum	6553.5
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw594

This parameter allows you to read the sensor flow.
See “[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [SENSORS] ~”, page 43.

[Act PID Ref]: (Actual PID Reference)

Minimum	0.0
Maximum	6553.5
Unit	%, kPa, bar, psi
Modbus Address	%mw596

This parameter allows you to read the PID reference implemented.
See “[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [PID] ~”, page 49.

[Local PID Ref]: (Local PID Reference)

Default	0
Minimum	0.0
Maximum	3200.0
Unit	%, kPa, bar, psi
Modbus Address	%mw598

This parameter allows you to choose PID locally if **[<EXPANSION>]** ~ **[PID]** ~ **[PID Reference]** = **[LOCAL]**.
See “[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [PID] ~”, page 49.

Water Solution Screen Navigation

[Feedback Pres]: (Feedback Pressure)

Minimum	0.0
Maximum	6553.5
Unit	%, kPa, bar, psi
Modbus Address	%mw600

This parameter allows you to read the feedback pressure.
See “[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [PID] ~”, page 49.

[System Status]: (System Status)

Minimum	1
Maximum	34
Modbus Address	%mw590

The system status is also available on the first line **[TIME:14:00]: [STATUS]** of the menu **[1.14 - WATER SOLUT.]**.
This parameter can take the following values:

Value	Long label	Short label	Description
1	OFF	OFF	system stopped
2	READY	RDY	system ready
4	JOCKEY ON	JKY	jockey pump active
6	PIPE FILL	FILL	filling in progress
7	SET RAMP	RAMP	starting ramp
8	PUMPING	PMP	pumping
9	VAR+1	V+1	variable pump active + 1 external pump active
10	VAR+2	V+2	variable pump active + 2 external pumps active
11	VAR+3	V+3	variable pump active + 3 external pumps active
12	Q LIMIT	QLT	flow limitation
13	SLEEP	SLP	sleep
14	BYPASS	BYP	pump switching
16	WAITING	WAIT	waiting system
17	LOCK OUT	LOCK	locked
18	PRO MAN	Pmm	protected manual mode
19	OVER MAN	Omm	override manual mode
20	SLEEP FUN	SLFU	test if sleep is in progress
21	NIGHT DAY	N+D	stop because mode night and day
25	INLET CMP	IN C	low pressure compensation during inlet
26	ANTI JAM	AJAM	anti jam in progress
27	FROST PRO	FST	anti frost enable
28	EXT FLT	EXTF	detected fault on auxiliary pump
29	LOW LEVEL	LLEV	low level reached
30	SLEEP BST	SBst	increasing in speed before sleeping
31	ADV SLEEP	ADVS	test advanced sleep
32	NOVAR+1	NV+1	variable pump not active + 1 external pump active
33	NOVAR+2	NV+2	variable pump not active + 2 external pumps active
34	NOVAR+3	NV+3	variable pump not active + 3 external pumps active

[Alt Local Ref]: (Alternative Local Reference)

Minimum	0.0
Maximum	6553.5
Unit	%, kPa, bar, psi
Modbus Address	%mw602

This parameter allows you to choose an alternative reference if **[<EXPANSION>]** ~ **[PID]** ~ **[Alt Local Ref]** = **[LOCAL]**.
See "[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [PID] ~", page 49.

[Inlet FB Pres]: (Inlet FB Pressure)

Minimum	0.0
Maximum	6553.5
Unit	%, kPa, bar, psi
Modbus Address	%mw604

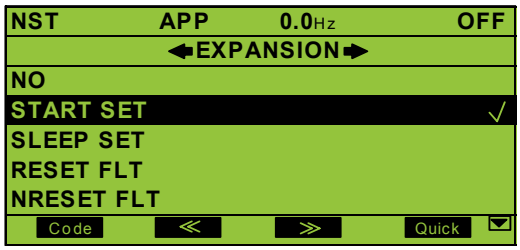
This parameter is available if **[<EXPANSION>]** ~ **[INLET PRO]** = **[Enable]**. It allows you to read inlet pressure.
See "[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [INLET PRO] ~", page 73.

[Inlet FB ADJ]: (Inlet FB Adjustment)

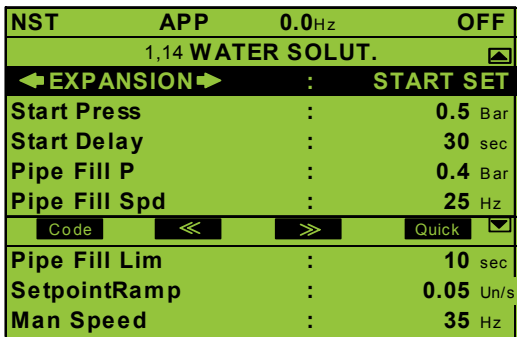
Minimum	0.0
Maximum	6553.5
Unit	%, kPa, bar, psi
Modbus Address	%mw606

This parameter is available if **[<EXPANSION>]** ~ **[INLET PRO]** = **[Enable]**. It allows you to read the adjustment of the pressure calculated automatically.
See "[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [INLET PRO] ~", page 73.

To configure the Water Solution, Multi-pump card, scroll down to **[<EXPANSION>]** and press enter.
Then select **[START SET]**

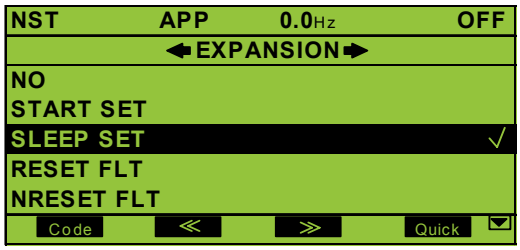


The following screen will be displayed:

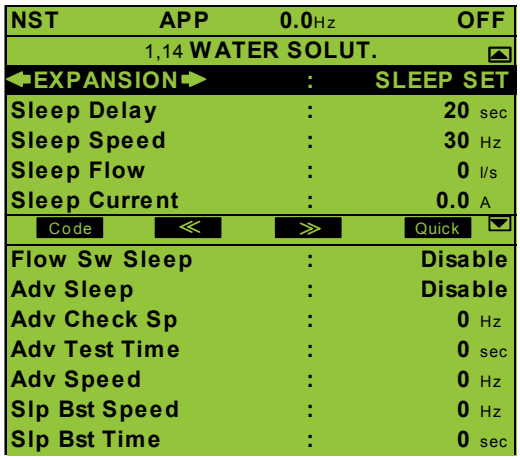


Water Solution Screen Navigation

Once the start settings have been modified, scroll back to **[<EXPANSION>]**, press enter, and then select **[SLEEP SET]**.



The following screen will be displayed:



Follow the same procedure to configure the variables for the desired functions.

Pre-configuration

To help ensure correct operation, certain standard drive parameters have been pre-configured to suit the Water Solution, Multi-pump card. These parameters are preset every time the power is cycled. They are

- **[Ref.1 channel]** (Fr1) = **[Prog.Card]** (APP) = 170
- **[Ref. 2 switching]** (rFC) = **[ch1 active]** (Fr1): No switching, **[Ref.1 channel]** (Fr1) active = 96
- **[Profile]** (CHCF) = **[Not separ.]** (SIM): Reference and command, not separate = 1
- **[Stop Key priority]** (PSt) = **[No]** (nO) = 0
- **[PID feedback ass.]** (PIF) = **[No]** (nO): Function inactive = 0
- **[Freewheel stop ass.]** (nSt) = **[No]** (nO): Not assigned = 0
- **[R1]** (R1) = **[No]** (nO) = 0 and **[R2]** (R2) = **[No]** (nO) = 0

⚠ WARNING

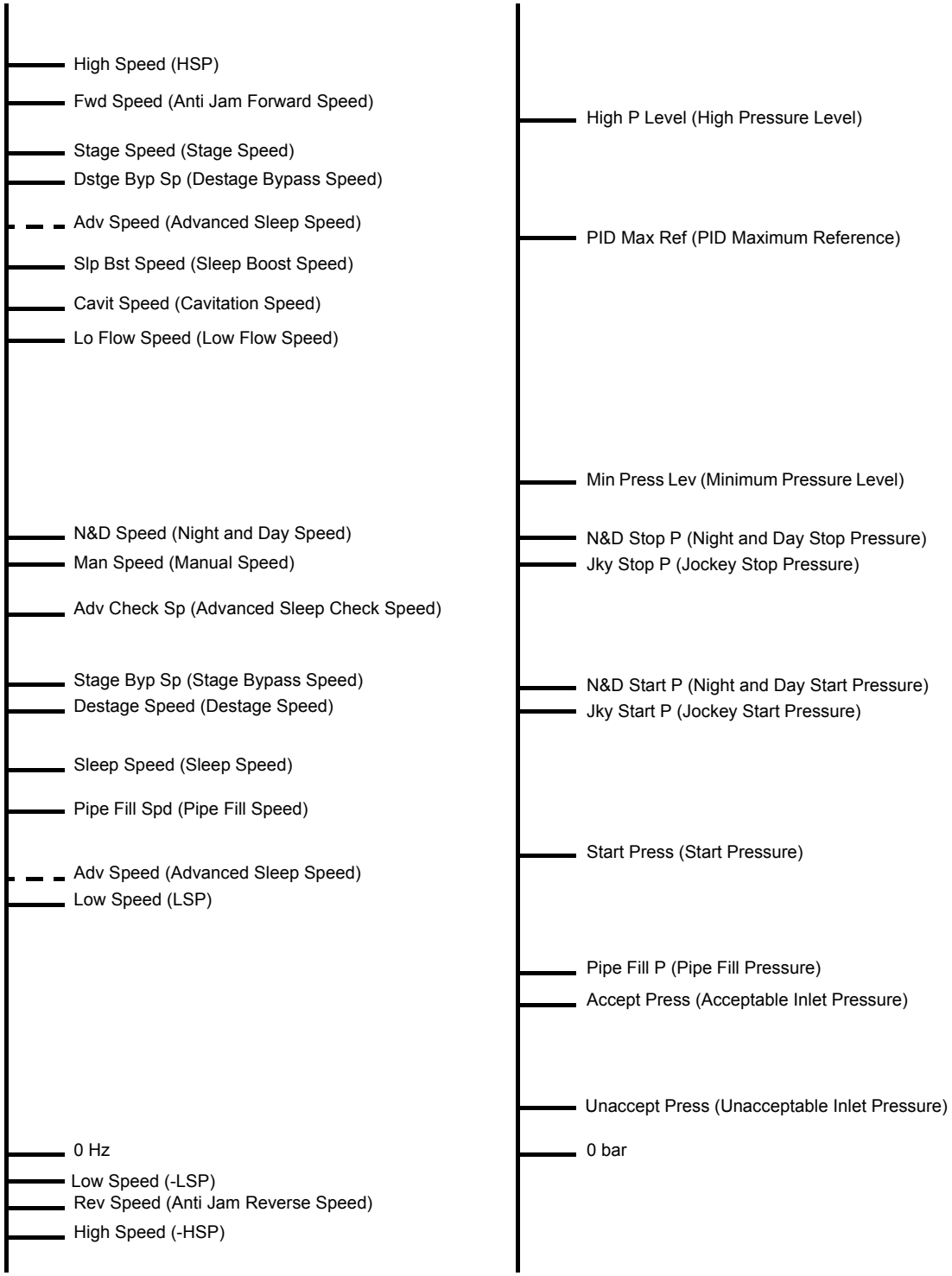
UNINTENDED EQUIPMENT OPERATION

Do not modify these parameters. They return to their pre-configured values each time the power is cycled.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Parameter Guide

The following diagram is a guide for parameter settings. It expresses the recommended values for speed and pressure in relative terms. For example, the recommended value for Fwd Speed (Anti Jam Forward Speed) is between High Speed (HSP) and Stage Speed (Stage Speed).



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [START SET] ~

[Start Press]: (Start Pressure)

Default	0.5
Minimum	**[Pipe Fill P]**
Maximum	**[PID Max Ref]**
Unit	%, kPa, bar, psi
Modbus Address	%mw300

On a rising edge from CI_LI57 (auto run), the system will enter the ready state. If after the **[Start Delay]** (**[<EXPANSION>]** ~ **[START SET]** ~ **[Start Delay]**) the feedback pressure is below the start pressure, the drive controller will start and invoke the pipefill function.

Alternatively the drive controller will start with no delay if the system has been in auto, enters the sleep condition, and the feedback pressure falls below the start pressure. Under these conditions, the pipefill functions is not invoked.

See figure 6, page 27

[Start Delay] : (Start Delay)

Default	30
Minimum	0
Maximum	999
Unit	sec
Modbus Address	%mw302

On a rising edge from CI_LI57 (auto run), the system will enter the ready state. If after the **[Start Delay]** the feedback pressure is below the start pressure, the drive controller will start.

The **[Start Delay]** is only active on a new start.

See figure 6, page 27

[Pipe Fill P]: (Pipe Fill Pressure)

Default	0.4
Minimum	0
Maximum	**[Start Press]**
Unit	%, kPa, bar, psi
Modbus Address	%mw304

The Pipe Fill function is used to determine when a minimum amount of back-pressure is present before allowing the system to enter PID control. This is to help prevent any integral wind-up of the PID controller. If the Pipe Fill function is not desired, set this parameter to zero. If the Pipe Fill function is required, the system will enter pipe fill when the drive controller performs a new start. The Pipe Fill function is only re-initialized after a rising edge on CI_LI57 (auto run) or a system/drive detected fault.

When the drive controller first starts, the system will enter pipe fill and display **[PIPE FILL]** (FILL) as the system status. The system will remain in pipe fill until either the feedback pressure is greater than the value entered for this parameter, or the system has been in pipe fill for longer than the time entered in screen **[<EXPANSION>]** ~ **[START SET]** ~ **[Pipe Fill Lim]**. If either of these conditions are met, the system will enter setpoint ramp.

See figure 6, page 27

[Pipe Fill Spd]: (Pipe Fill Speed)

Default	25
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw306

When in pipe fill mode, the drive controller will run at this speed.

See figure 6, page 27

[Pipe Fill Lim]: (Pipe Fill Limit)

Default	10
Minimum	0
Maximum	32767
Unit	sec
Modbus Address	%mw308

If the system has been in pipe fill mode for longer than the time specified in this screen, it will enter setpoint ramp mode regardless of the feedback pressure.
This parameter is used to keep the system from remaining in the pipe fill mode when a large demand is present and the system cannot get the feedback pressure to a value greater than the value entered in **[<EXPANSION>]** ~ **[START SET]** ~ **[Pipe Fill P]**.

See figure 6, page 27

[Setpoint Ramp]: (Setpoint Ramp)

Default	0.05
Minimum	0.01
Maximum	327.67
Unit	Un/s (units per second)
Modbus Address	%mw310

Setpoint ramp is used to help prevent integral wind-up of the PID controller during a start sequence. If the selected setpoint is applied directly to the PID controller when the feedback pressure is low, the large error will cause the PID to make large motor speed adjustments to overcome this error. This can result in pressure spikes and water hammer. By ramping the setpoint up at a rate the system can effectively manage, this problem is overcome. The ramp rate is specified in user-defined units per second.

Assuming the system has left Pipe Fill mode and the feedback at this point is 2.0 bar, then if the selected setpoint is 4.0 bar and the ramp rate set is 0.2 units/sec, the setpoint will take 10 seconds to ramp up to 4.0 bar.

During setpoint ramp, the system status will display **[SET RAMP]** (RAMP). This will remain displayed until the applied setpoint has reached the selected setpoint, and the pressure feedback is greater than or equal to the selected setpoint.

Note that the system will stage external pumps if staging permissives are met.

See figure 6, page 27

[Man Speed]: (Manual Speed)

Default	35
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw312

CI_LI51	Protected Manual Mode
CI_LI52	Override manual Mode
CI_LI57	Auto Run

The three pump modes are mutually exclusive, so if more than one of the above inputs is true, the system will become locked out and the status display will show **[LOCK OUT]** (LOCK).

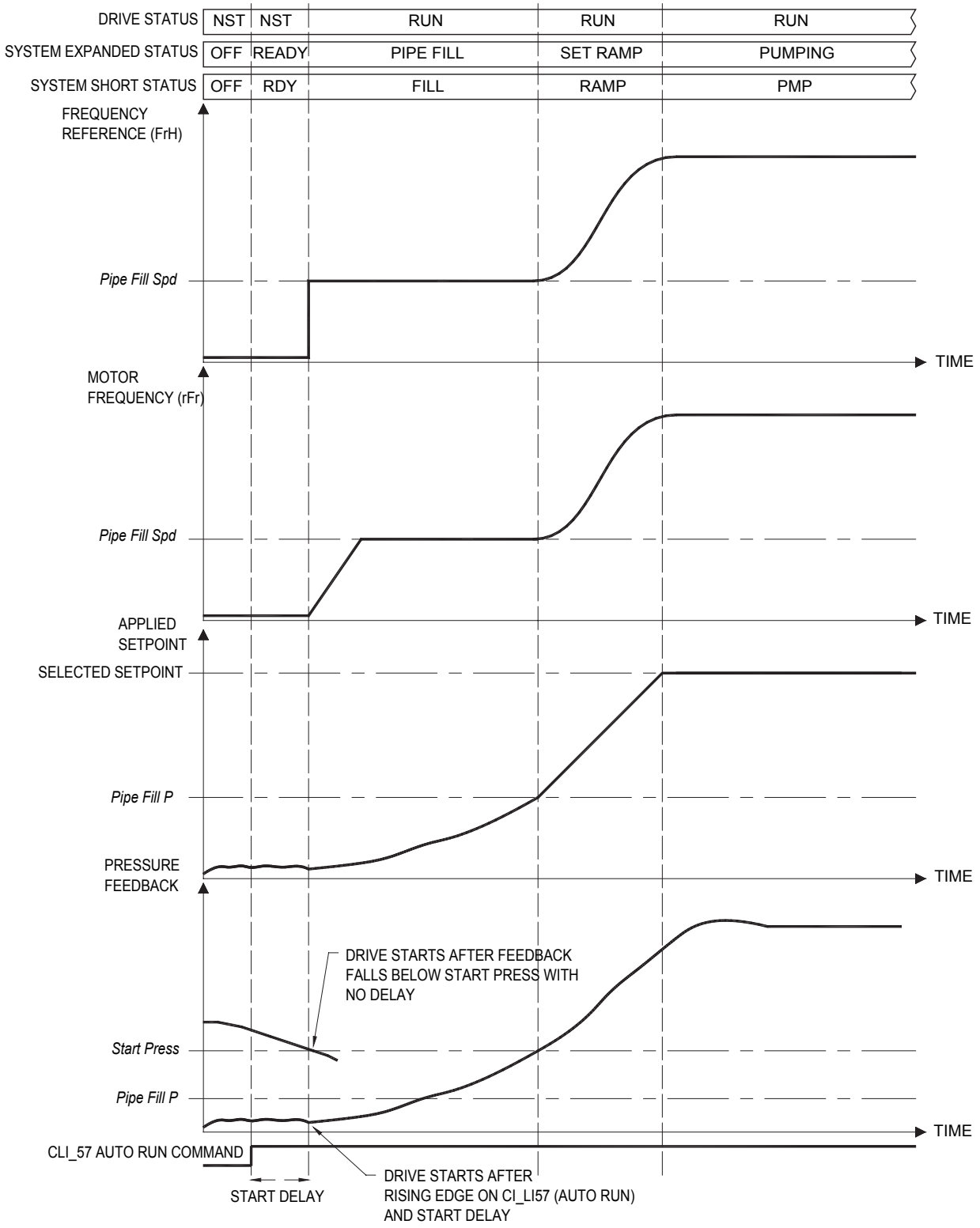
If only CI_LI51 is true, the status display will show **[PRO MAN]** (Pmm), and the speed reference will be that set in this screen. All of the system detection features are still valid in this mode (high pressure, etc.).

If only CI_LI52 is true, the status display will show **[OVER MAN]** (Omm), and the speed reference will be that set in this screen. No system detection features are valid in this mode (high pressure, etc., are ignored).

Start Settings

The diagram below describes the Start Settings.

Figure 6



Note: Pipefill only occurs on rising edge after on CI_LI57 (Autorun)

[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [SLEEP SET] ~

[Sleep Delay]: (Sleep Delay)

Default	20
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw314

If the sleep function permissives are met, the drive controller will switch off and enter the sleep state after this delay.

See figure 7, page 31

[Sleep Speed]: (Sleep Speed)

Default	30
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw316

If the drive speed falls below this value after the Pipe Fill function, the sleep delay timer will be started. During the sleep delay time, the status will display **[SLEEP FUN]** (SLFU). If the speed remains below this value for longer than the sleep delay time, the drive controller will accelerate to the sleep boost speed for the sleep boost time, and then stop and enter the sleep state. The status will now display **[SLEEP]** (SLP).

See figure 7, page 31

[Sleep Flow]: (Sleep Flow)

Default	0.00
Minimum	0
Maximum	65535
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw318

If the flow falls below this value after the Pipe Fill function, the sleep delay timer will be started. During the sleep delay time, the status will display **[SLEEP FUN]** (SLFU). If the flow remains below this value for longer than the sleep delay time, the drive controller will accelerate to the sleep boost speed for the sleep boost time, and then stop and enter the sleep state. The status will now display **[SLEEP]** (SLP).

See figure 7, page 31

[Sleep Current]: (Sleep Current)

Default	0.0
Minimum	0
Maximum	2 * Drive rated current
Unit	A
Modbus Address	%mw320

If the motor current falls below this value after the Pipe Fill function, the sleep delay timer will be started. During the sleep delay time, the status will display **[SLEEP FUN]** (SLFU). If the current remains below this value for longer than the sleep delay time, the drive controller will accelerate to the sleep boost speed for the sleep boost time, and then stop and enter the sleep state. The status will now display **[SLEEP]** (SLP).

See figure 7, page 31

[Flow Sw Sleep]: (Flow Switch Sleep)

Default	[Disable]
Range	[Disable] or [Enable]
Modbus Address	%mw322

This parameter allows the you to select whether or not the flow switch (if installed) is used to invoke the sleep function. If this parameter is enabled and the CI_LI53 input is not active after the Pipe Fill function, the sleep delay timer will be started. During the sleep delay time the status will display **[SLEEP FUN]** (SLFU). If input CI_LI53 remains inactive for longer than the sleep delay time, the drive controller will accelerate to the sleep boost speed for the sleep boost time, and then stop and enter the sleep state. The status will now display **[SLEEP]** (SLP).

See figure 7, page 31

[Adv Sleep]: (Advanced Sleep)

Default	[Disable]
Range	[Disable] or [Enable]
Modbus Address	%mw324

This parameter allows you to select whether the advanced sleep function is used.

See figure 8, page 32
See figure 9, page 33

[Adv Check Sp]: (Advanced Check Speed)

Default	0
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw326

If a fall in demand does not cause either a significant fall in speed or current, the advanced sleep function is used to periodically monitor the demand. This is typically required when the pump curve is particularly flat and a flow switch or meter is not installed.
If the drive speed is below the value entered here, for greater than the time entered in screen **[<EXPANSION>]** ~ **[SLEEP SET]** ~ **[Adv Test Time]**, the system will revert to the speed reference entered in screen **[<EXPANSION>]** ~ **[SLEEP SET]** ~ **[Adv Speed]**. While adjusting the speed to this new value, the PID is disabled to help prevent integral wind-up effects when leaving the advanced sleep function. As soon as the Adv Speed is achieved, the system reverts to PID control. There are two usual methods of checking for no demand, they are overspeed testing and underspeed testing.

In the case of overspeed testing, the **[Adv Speed]** is set above the **[Adv Check Sp]** which will cause a negative error on the PID (setpoint-feedback) if no demand is present. This in turn will cause the system to begin reducing the motor speed. As there is no demand, the PID error will remain and the motor speed will continue to be reduced until the minimum speed (LSP) is reached. When commissioned correctly, this will cause the system to enter the sleep mode.

In the case of underspeed testing, the **[Adv Speed]** is set below parameter **[<EXPANSION>]** ~ **[SLEEP SET]** ~ **[Sleep Speed]** which will cause no error on the PID (setpoint-feedback) if no demand is present. As there is no demand, there will be no PID error, and therefore the system will maintain motor speed below **[Sleep Speed]**. When commissioned correctly, this will cause the system to enter the sleep mode.

See figure 8, page 32
See figure 9, page 33

[Adv Test Time]: (Advanced Test Time)

Default	0
Minimum	0
Maximum	9999
Unit	sec
Modbus Address	%mw328

Before the advanced sleep function is activated, make sure that the motor speed has been below **[Adv Speed]** for a duration longer than **[Adv Test Time]**.

See figure 8, page 32
See figure 9, page 33

[Adv Speed]: (Advanced Speed)

Default	0
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw330

If the advanced sleep function is active, the system will revert to this speed reference.

See figure 8, page 32
See figure 9, page 33

[Slp Bst Speed]: (Sleep Boost Speed)

Default	0
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw332

Immediately before entering the sleep state, the drive output frequency is set to the value entered in this screen for the time entered in screen **[<EXPANSION>]** ~ **[SLEEP SET]** ~ **[Slp Bst Time]**.

See figure 7, page 31
See figure 8, page 32
See figure 9, page 33

[Slp Bst Time]: (Sleep Boost Time)

Default	0
Minimum	0
Maximum	32767
Unit	sec
Modbus Address	%mw334

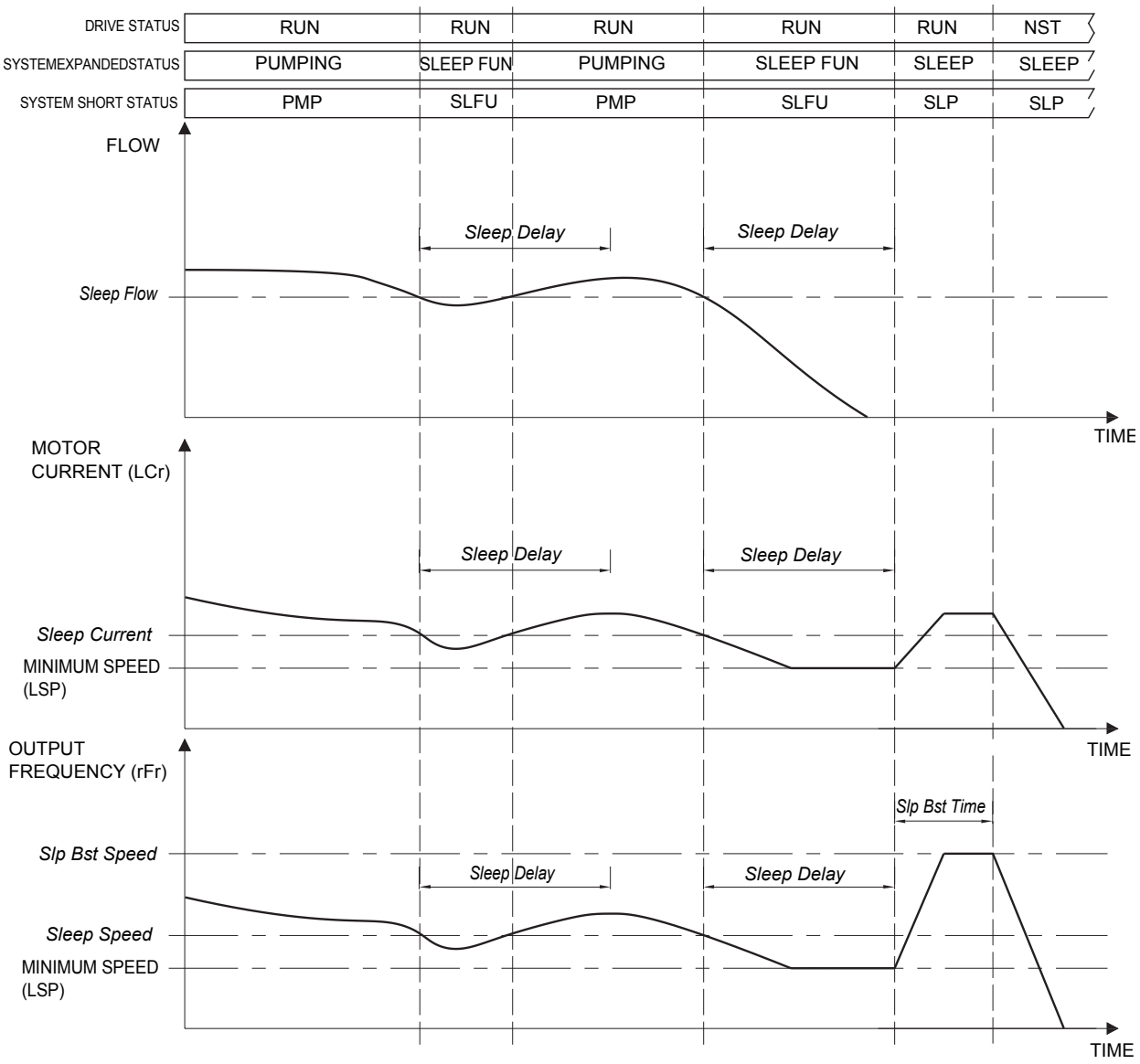
Immediately before entering the sleep state, the drive output frequency is set to **[Slp Bst Speed]** for the time entered in this screen.

See figure 7, page 31
See figure 8, page 32
See figure 9, page 33

Standard Sleep Functions

The following diagram describes the Standard Sleep Functions.

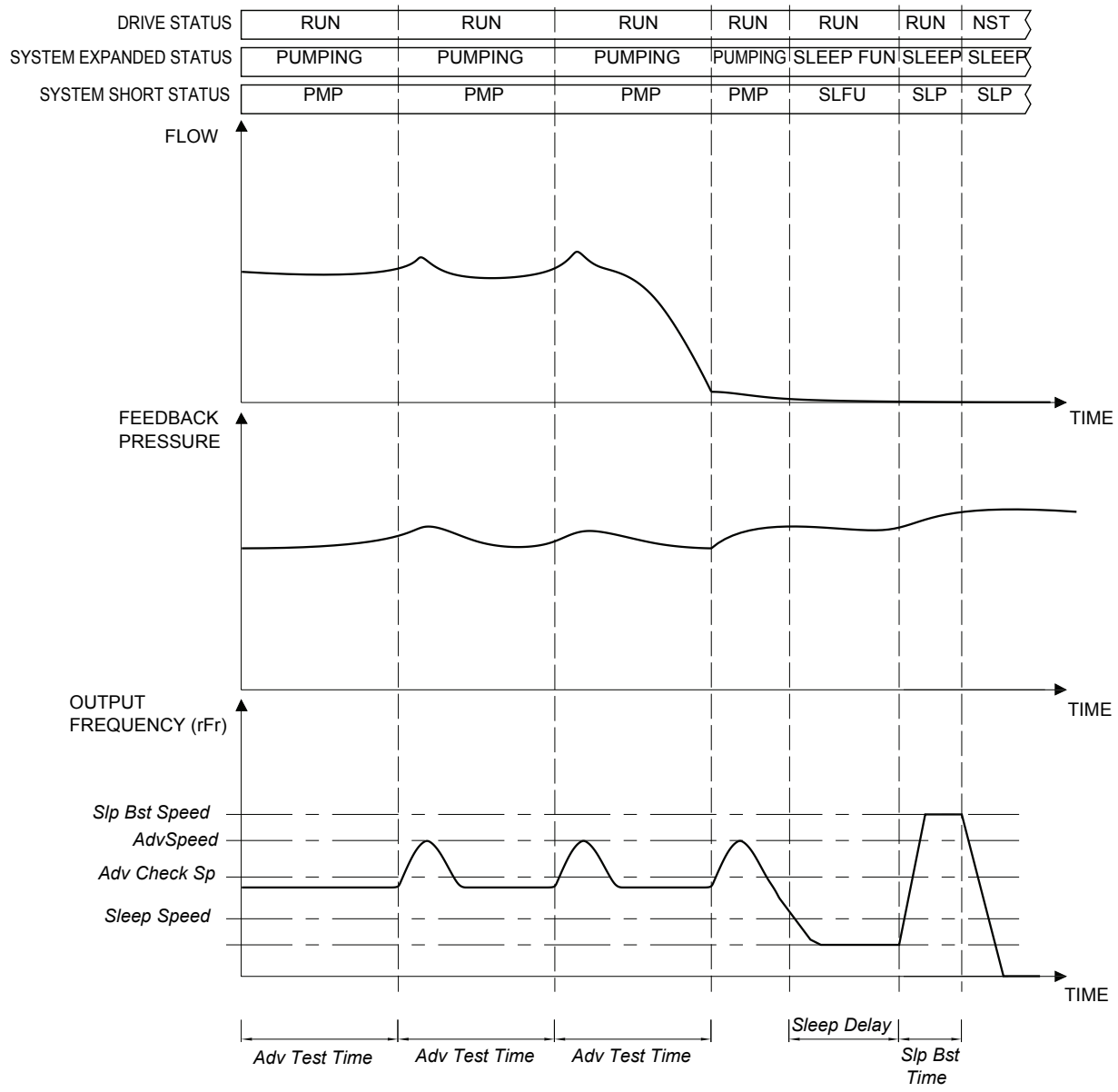
Figure 7



Overspeed Advanced Sleep Function

The following diagram describes the Overspeed Advanced Sleep Function.

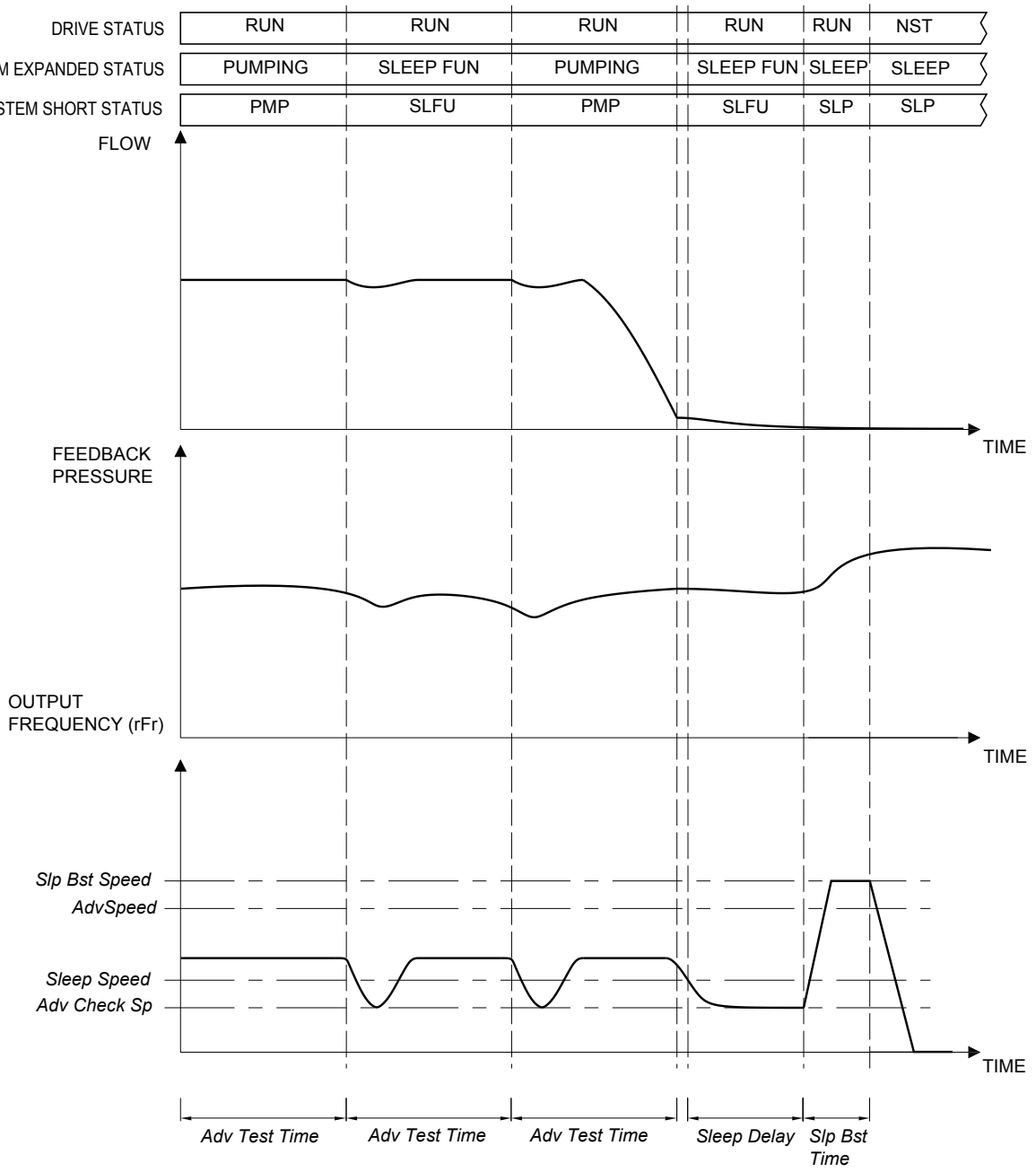
Figure 8



Underspeed Advanced Sleep Function

The following diagram describes the Underspeed Advanced Sleep Function.

Figure 9



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [RESET FLT] ~

[No Reset Att]: (Number of Reset Attempts)

Default	5
Minimum	0
Maximum	10
Modbus Address	%mw336

If any of the resettable system faults, high pressure, cavitation, or low flow have their auto reset functionality enabled, the number entered in this screen is the number of resets that will be performed for that particular system fault. These attempts will be made at intervals set by parameter **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Reset Pause]**.

If the system trips more times than set in this screen within the time set in screen **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Att Time]**, no reset will be performed and the system will need to be reset by activating the reset (digital input CI_LI58), toggling the auto run command (digital input CI_LI57), or pressing the stop reset button on the operator display. By resetting the system, all system fault counters are reset to zero. These system fault counters are cumulative in that they are not reset to zero each time the **[Decrement Dly]** rolls over, but have the individual system fault counters decremented by one. This means that if there are three consecutive high pressure faults, it will take three times **[Decrement Dly]** before the high pressure counter is reset to zero.

See figure 11, page 40

[Decrement Dly]: (Decrement Delay)

Default	3600
Minimum	0
Maximum	9999
Unit	sec
Modbus Address	%mw338

The system faults of high pressure, cavitation, and low flow can be configured to have no consequence, to trip the system, or to trip the system with auto reset capability. If auto reset is selected in screens

[<EXPANSION>] ~ **[RESET FLT]** ~ **[Hi P Fault]** or
[<EXPANSION>] ~ **[RESET FLT]** ~ **[Cavit Fault]** or
[<EXPANSION>] ~ **[RESET FLT]** ~ **[Flow Fault]**

and if the respective individual system fault counter is below **[No Reset Att]** and if that system fault has caused the system to trip, then the system will reset after the delay set in screen **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Reset Pause]**. If however the respective system fault counter is equal to **[No Reset Att]**, then no reset will be performed, and the system will need to be reset by activating the reset (digital input CI_LI58), toggling the auto run command (digital input CI_LI57), or by cycling the power to the drive controller/Water Solution, Multi-pump card combination.

See figure 11, page 40

[Reset Pause]: (Reset Pause)

Default	3600
Minimum	0
Maximum	9999
Unit	sec
Modbus Address	%mw340

The resettable system faults of high pressure, cavitation, and low flow can be configured to have no consequence, to trip the system, or to trip the system with auto reset capability. If auto reset is selected in screens

[<EXPANSION>] ~ **[RESET FLT]** ~ **[Hi P Fault]** or
[<EXPANSION>] ~ **[RESET FLT]** ~ **[Cavit Fault]** or
[<EXPANSION>] ~ **[RESET FLT]** ~ **[Flow Fault]**

and if the respective individual system fault counter is below **[No Reset Att]** and if that system fault has caused the system to trip, then the system will reset after the delay set in this screen. If however the respective system fault counter is equal to **[No Reset Att]**, then no reset will be performed, and the system will need to be reset by activating the reset (digital input CI_LI58), toggling the auto run command (digital input CI_LI57), or by cycling the power to the drive controller/Water Solution, Multi-pump card combination.

See figure 11, page 40

[Hi P Fault]: (High Pressure Fault)

Default	Disable
Range	**[Disable]**, **[Enable]** or **[Aut Reset]**
Modbus Address	%mw342

This screen is used to select the desired response to a high pressure fault sensed either by digital input Drive_LI3 being inactive for more than one second, or by the measured analog pressure feedback being greater than **[High P Level]** for longer than **[Hi P Delay]**.

If **[Disable]** is selected, then no action is taken by the system if a high pressure fault is detected.

If **[Enable]** is selected and a high pressure fault is detected, the system will trip and display **[HI PRESS]**. Pushing Function key F1 will show the screen relevant to the high pressure fault.

If **[Aut Reset]** is selected and a high pressure fault is detected, the system will trip and display **[HI PRESS]**. Pushing Function key F1 will show the screen relevant to the high pressure fault. After the time delay **[Reset Pause]**, the system will automatically reset as long as the respective individual system fault counter is less than **[No Reset Att]**.

[Hi P Level]: (High Pressure Level)

Default	5.0
Minimum	0
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw344

A high pressure fault is detected when the feedback pressure is greater than the value entered in this screen for longer than **[Hi P Delay]**.

[Hi P Delay]: (High Pressure Delay)

Default	10
Minimum	0
Maximum	999
Unit	sec
Modbus Address	%mw346

A high pressure fault is detected when the feedback pressure is greater than **[Hi P Level]** for longer than the value entered in this screen.

[Cavit Fault]: (Cavitation Fault)

Default	**[Disable]**
Range	**[Disable]**, **[Enable]** or **[Aut Reset]**
Modbus Address	%mw348

This screen is used to select the desired response to a cavitation fault sensed by the motor current being less than **[Cavit Current]** while the motor speed is above **[Cavit Speed]** for longer than **[Cavit Delay]**.

If **[Disable]** is selected, then no action is taken by the system if cavitation is detected.

If **[Enable]** is selected and cavitation is detected, the system will trip and display **[CAVITATION]**. Pushing Function key F1 will show the screen relevant to the fault.

If **[Aut Reset]** is selected and cavitation is detected, the system will trip and display **[CAVITATION]**. Pushing Function key F1 will show the screen relevant to the fault. After the time delay **[Reset Pause]**, the system will automatically reset as long as the respective individual fault counter is less than **[No Reset Att]**.

See figure 11, page 40

[Cavit Current]: (Cavitation Current)

Default	0
Minimum	0
Maximum	2 * Drive rated current
Unit	A
Modbus Address	%mw350

Cavitation is detected when the motor current is below the value entered in this screen while the motor speed is above **[Cavit Speed]** for longer than **[Cavit Delay]**.

See figure 11, page 40

[Cavit Speed]: (Cavitation Speed)

Default	50
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw352

Cavitation is detected when the motor speed is above the value entered in this screen while the motor current is below **[Cavit Current]** for longer than **[Cavit Time]**.

See figure 11, page 40

[Cavit Time]: (Cavitation Time)

Default	10
Minimum	0
Maximum	999
Unit	sec
Modbus Address	%mw354

Cavitation is detected when the motor speed is above **[Cavit Speed]** while the motor current is below **[Cavit Current]** for longer than the value entered in this screen.

See figure 11, page 40

[Flow Fault]: (Flow Fault)

Default	**[Disable]**
Range	**[Disable]**, **[Enable]** or **[Aut Reset]**
Modbus Address	%mw356

This screen is used to select the desired response to a flow fault.

There are two ways the system detects a flow fault: either by sensing that digital input CI_LI53 is inactive, or by the flow feedback being below **[Lo Flow Level]**. Select which sensing mechanism to use in screen **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Lo Flow Sel]**.

Regardless of the sensing mechanism selected, low flow detection can be disabled during pipe fill.
This is done in screen **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Fill Flow Pro]**.

If **[Fill Flow Pro]** is set to **[No]** (no low flow detection during pipefill) and **[Flow Rate]** or **[Either]** is selected in screen **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Lo Flow Sel]**, on completion of the Pipe Fill function and the low flow detection start delay, **[Lo Flo Delay]**, a low flow fault occurs if the flow feedback is below **[Lo Flow Level]** for longer than **[Lo Flo Filter]** and the motor speed is above **[Lo Flo Speed]**.

Alternatively, if **[Fill Flow Pro]** is set to **[No]** (no low flow detection during pipefill) and **[Flow Sw]** or **[Either]** is selected in screen **[<EXPANSION>]** ~ **[RESET FLT]** ~ **[Lo Flow Sel]**, on completion of the Pipe Fill function and the low flow detection start delay, **[Lo Flo Delay]**, a low flow fault occurs if digital input CI_LI53 is inactive for longer than **[Lo Flo Filter]** and the motor speed is above **[Lo Flo Speed]**.

If **[Disable]** is selected in this screen, then no action is taken by the system if low flow is detected.

If **[Enable]** is selected and a flow fault is generated due to flow feedback, the system will trip and display **[FLOW RATE]**. If a flow fault is generated due to digital input CI_LI53 being inactive, the system will trip and display **[NO FLOW]**. Pushing Function key F1 will show the fault screen relevant to the fault.

If **[Aut Reset]** is selected and a flow fault is generated due to flow feedback, the system will trip and display **[FLOW RATE]**. If a flow fault is generated due to digital input CI_LI53 being inactive, the system will trip and display **[NO FLOW]**. Pushing Function key F1 will show the fault screen relevant to the fault. After the time delay **[Reset Pause]**, the system will automatically reset as long as the respective individual fault counter is less than **[No Reset Att]**.

See figure 10, page 39

[Lo Flow Sel]: (Low Flow Selection)

Default	**[Flow Sw]**
Range	**[Flow Rate]**, **[Flow Sw]** or **[Either]**
Modbus Address	%mw358

This screen selects whether the flow feedback, the flow switch, or both are used to trip the system under low flow conditions.

See figure 10, page 39

[Lo Flo Level]: (Low Flow Level)

Default	0
Minimum	0
Maximum	327.67
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw360

If **[Flow Rate]** or **[Either]** is selected in screen **[Lo Flow Sel]**, then the flow rate must be below this level for a flow rate generated fault to occur.

See figure 10, page 39

[Lo Flo Speed]: (Low Flow Speed)

Default	25
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw362

The motor speed must be above the value entered in this screen for a flow fault to be generated.

See figure 10, page 39

[Lo Flo Delay]: (Low Flow Delay)

Default	30
Minimum	0
Maximum	999
Unit	sec
Modbus Address	%mw364

If low flow sensing during Pipe Fill is enabled in screen **[Fill Flow Pro]**, then as soon as the drive controller starts, the Low Flow Delay is started. A flow fault can only occur after this delay has timed out.

Alternatively, if low flow sensing during Pipe Fill is disabled in screen **[Fill Flow Pro]**, then as soon as the Pipe Fill has finished, the **[Lo Flo Delay]** is started. A flow fault can only occur after this delay has timed out.

See figure 10, page 39

[Lo Flo Filter]: (Low Flow Filter)

Default	2
Minimum	0
Maximum	999
Unit	sec
Modbus Address	%mw366

After **[Lo Flo Delay]**, the flow rate or flow switch permissives must be met for a time greater than the time set in this screen before the system will trip. This value is a de-bounce time to reduce nuisance faults.

See figure 10, page 39

[Fill Flow Pro]: (Fill Flow Detection)

Default	**[NO]**
Range	**[NO]** or **[YES]**
Modbus Address	%mw368

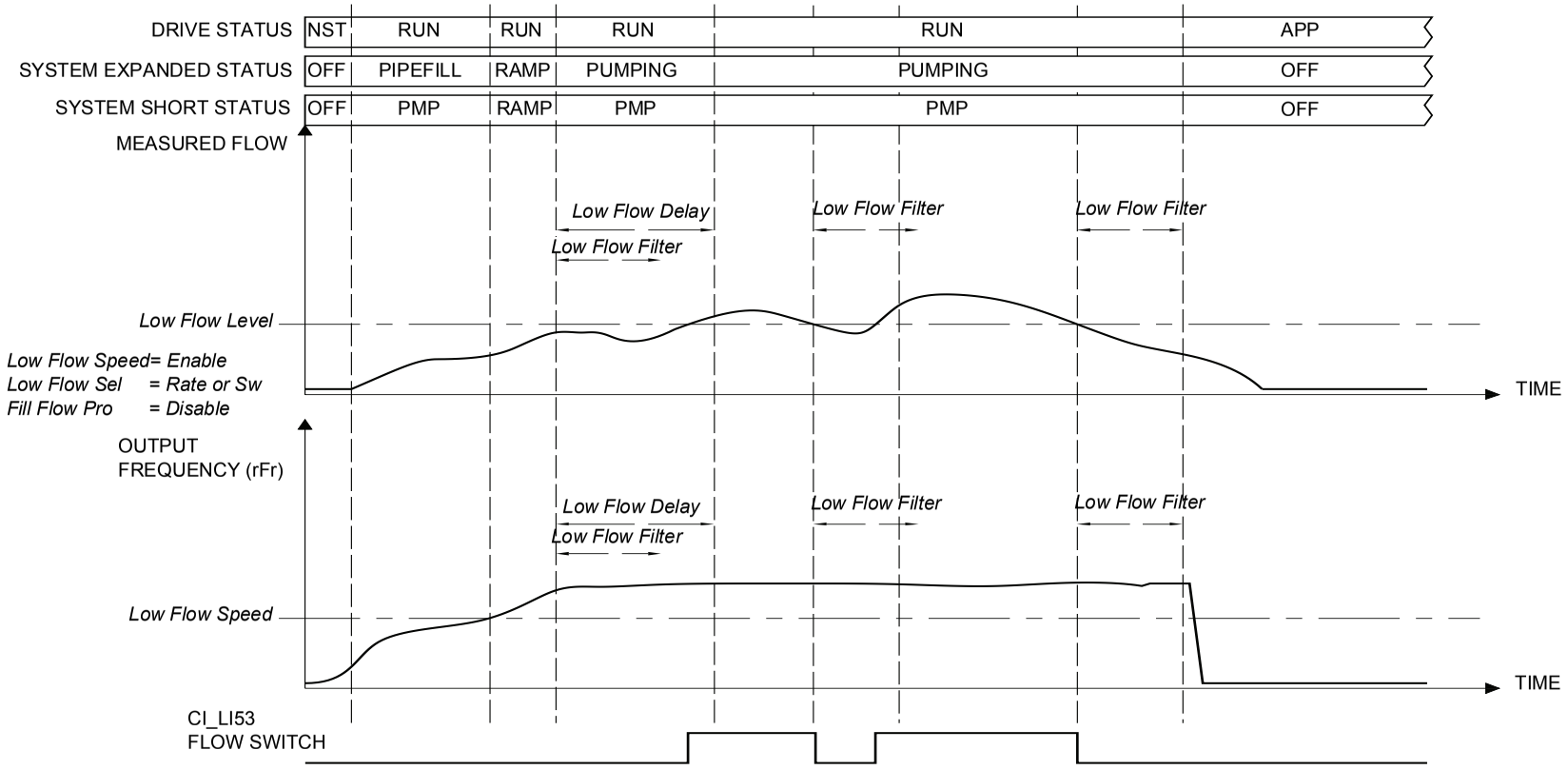
If this function is enabled (**[YES]** selected), the low flow detection is active during pipe fill. In this case, the **[Lo flo delay]** starts at the beginning of the pipe filling.
If disabled (**[NO]** selected), the low flow detection is only active after pipe fill has finished. In this case, the **[Lo flo delay]** starts after the pipe fill and the ramp.

See figure 10, page 39

Resettable System Faults

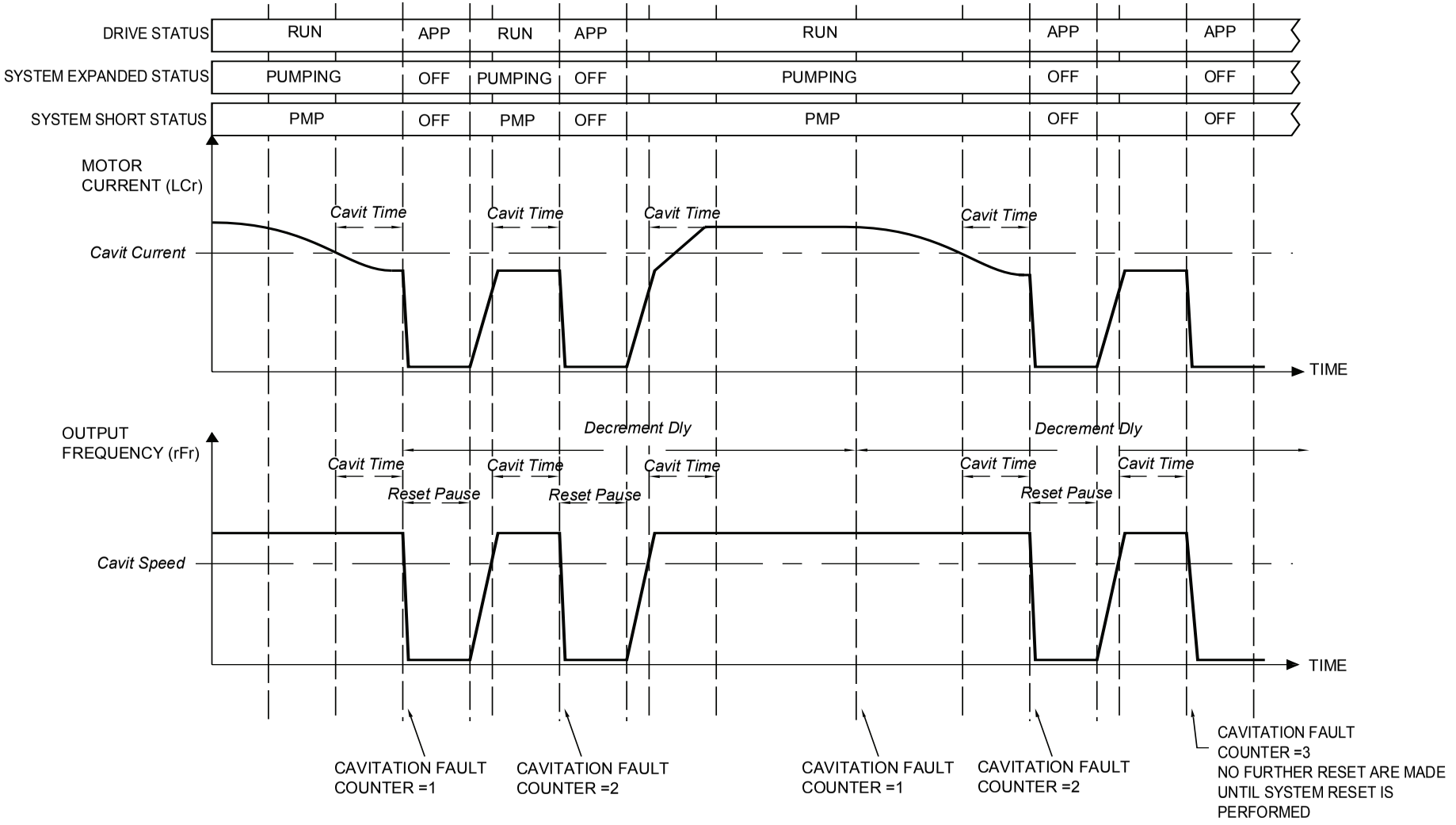
The following diagrams describe the resettable system faults.

Figure 10



Parameter Descriptions

Figure 11



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [NRESET FTL] ~

[Cycle Time]: (Cycle Time)

Default	60
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw370

If the drive controller restarts more times than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Cycle Count]** in a time defined in **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Cycle Time]**, the system will trip and require a reset via activation of CI_LI58, toggling the auto command (CI_LI57), or pushing the drive stop/reset button.

[Cycle Count]: (Cycle count)

Default	3
Minimum	0
Maximum	99
Modbus Address	%mw372

If the drive controller restarts more times than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Cycle Count]** in a time defined in **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Cycle Time]**, the system will trip and require a reset via activation of CI_LI58, toggling the auto command (CI_LI57), or pushing the drive stop/reset button.

See figure 12, page 42

[Min Press Flt]: (Minimum Pressure Fault)

Default	**[Disable]**
Range	**[Disable]** or **[Enable]**
Modbus Address	%mw374

If the drive controller is running, the system is not in Override Manual mode, and the feedback pressure is less than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Min Press Lev]** for longer than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Min Press Dly]**, the system will trip and display **[MIN PRESS]**.

[Min Press Lev]: (Minimum Pressure Level)

Default	0.0
Minimum	0.0
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw376

If the drive controller is running, the system is not in Override Manual mode, and the feedback pressure is less than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Min Press Lev]** for longer than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Min Press Dly]**, the system will trip and display **[MIN PRESS]**.

[Min Press Dly]: (Minimum Pressure Delay)

Default	10
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw378

If the drive controller is running, the system is not in Override Manual mode, and the feedback pressure is less than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Min Press Lev]** for longer than **[<EXPANSION>]** ~ **[NRESET FLT]** ~ **[Min Press Dly]**, the system will trip and display **[MIN PRESS]**.

[Low Level]: (Low Level)

Default	[Disable]
Range	[Disable] or [Enable]
Modbus Address	%mw380

If the drive controller is running, the system is not in Override Manual mode, digital input CI_LI60 is inactive for longer than [<EXPANSION>] ~ [NRESET FLT] ~ [Low Lev Dly], and this screen is set to [Enable], the system will trip and display [LOW LEVEL].

[Low Level Dly]: (Low Level Delay)

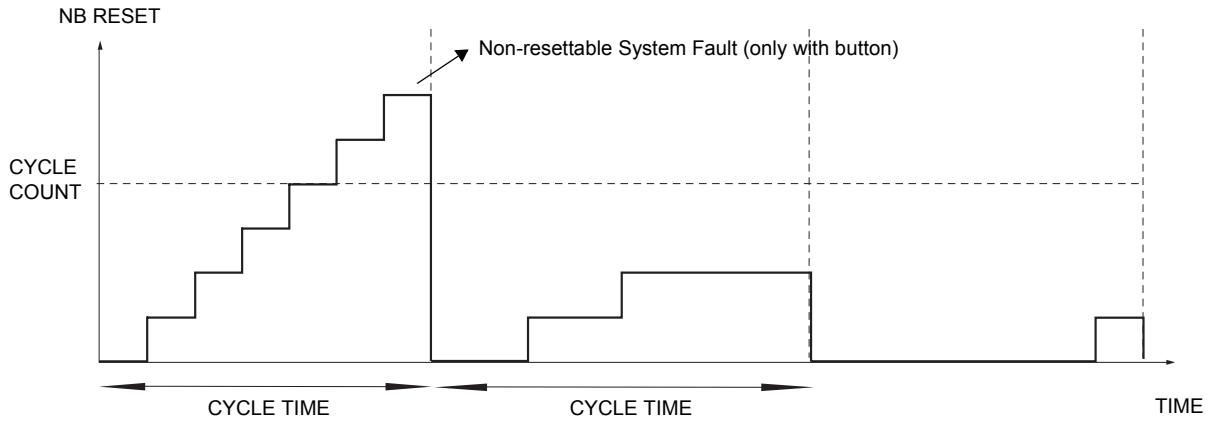
Default	2
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw382

If the drive controller is running, the system is not in Override Manual mode, digital input CI_LI60 is inactive for longer than the time entered in this screen, and [Low Lev] is set to [Enable], the system will trip and display [LOW LEVEL].

Reset

The following diagram describes the Cycle Count as a function of the Cycle Time.

Figure 12



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [SENSORS] ~

[Outlet TX Max]: (Outlet Transducer Maximum)

Default	10.0
Minimum	0.1
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw384

This screen is used to inform the system of the range of the transducer being used to measure outlet/discharge pressure. It is assumed that the minimum is zero (i.e., a 0-10 bar transducer would be selected rather than a 2-10 bar device). If the transducer used is a 4-20 mA and 0-10.0 bar device, then 10.0 should be entered in this screen.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for outlet/discharge pressure, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

[Inlet TX Max]: (Inlet Transducer Maximum)

Default	10.0
Minimum	0.1
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw386

This screen is used to inform the system of the range of the transducer being used to measure inlet/suction pressure. It is assumed that the minimum is zero (i.e., a 0-10 bar transducer would be selected rather than a 2-10 bar device). If the transducer used is a 4-20 mA and 0-10.0 bar device, then 10.0 should be entered in this screen.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for inlet/suction pressure, it must be correctly configured in screens
[<EXPANSION>] ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

[Press Units]: (Pressure Units)

Default	bar
Range	%, kPa, bar and psi
Modbus Address	%mw388

This screen sets the units for all screens that display, or allow modification of, a pressure value. The unit selected is for display purposes only, and in no way affects any numerical values.

After changing the unit, the screens in this sub-group (**[WATER SOLUT.]** ~ **[<EXPANSION>]** ~ **[SENSORS]** ~) are not updated until another sub-group is selected and this one is subsequently re-entered.

Note that if any unit other than pressure is selected, it will switch back to a pressure unit.

[Flow Source]: (Flow Source)

Default	[NONE]
Range	[NONE], CI_LI59, DRIVE_AI1, DRIVE_AI2, DRIVE_AI3, DRIVE_AI4, CI_AI51, CI_AI52
Modbus Address	%mw390

This screen configures the type of transducer that is used to measure flow. If a pulse flow meter is used, CI_LI59 must be selected. If an analog meter is used, select one of the analog sources. If no flow transducer is used, select [NONE].

Note the following:

1 If one of the Water Solution, Multi-pump card analog inputs is used, it must be correctly configured in screens [<EXPANSION>] ~ [CONFIG] ~ [CI_AI51 Type] or [<EXPANSION>] ~ [CONFIG] ~ [CI_AI52 Type] respectively.

2 If any of the analog sources are selected, the adjustable range is determined by the flow unit that is selected in screen [<EXPANSION>] ~ [SENSORS] ~ [Flow Units].

If Liters/s is selected, there will be two decimal places
If Liters/m is selected, there will be one decimal place
If Liters/h is selected, there will be no decimal places in the following screens:

[Flow Display]
[<EXPANSION>] ~ [SLEEP SET] ~ [Sleep Flow]
[<EXPANSION>] ~ [RESET FLT] ~ [Lo Flow Level]
[<EXPANSION>] ~ [SENSORS] ~ [Flow AIN Tx]
[<EXPANSION>] ~ [FLOW LMT] ~ [Flow Limit]
[<EXPANSION>] ~ [FLOW LMT] ~ [Flo Lmt Reset]
[<EXPANSION>] ~ [FLOW COMP] ~ [Known Flow]
[<EXPANSION>] ~ [FLOW COMP] ~ [Known Flow]

This equates to a maximum measured flow rate of 655.35 liters per second, 6553.5 liters per minute, or 65535 liters per hour when an analog flow meter source is used.

3 If CI_LI59 is selected, the number of decimal places for the screens listed above is determined as follows:

If [<EXPANSION>] ~ [SENSORS] ~ [Volume] / [<EXPANSION>] ~ [SENSORS] ~ [Pulses/volume] is less than 0.1, then two decimal places are used.

If [<EXPANSION>] ~ [SENSORS] ~ [Volume] / [<EXPANSION>] ~ [SENSORS] ~ [Pulses/volume] is greater than or equal to 0.1 and less than or equal to 1, one decimal place is used, otherwise no decimal places are used.

Therefore a pulse flow transducer with 20 pulses per liter will cause two decimal places, a pulse flow transducer with 5 pulses per liter will cause one decimal place, and a pulse flow transducer with 1 pulse per 10 liters will cause no decimal places.

[Flow AIN Tx]: (Flow Transducer Analog Input Maximum)

Default	0.00
Minimum	0.00
Maximum	65535
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw392

This screen is used to inform the system of the range of the transducer being used to measure Flow if an analog transducer is used. This screen is redundant if CI_LI59 or [NONE] was selected in screen [<EXPANSION>] ~ [SENSORS] ~ [Flow Source].
It is assumed that the minimum is zero (i.e., a 0-10 bar transducer would be selected rather than a 2-10 bar device). If the transducer used is a 0-20 mA and 0-10000 Liters/s device, then 10000 should be entered in this screen.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for inlet/suction pressure, then it must be correctly configured in screens [<EXPANSION>] ~ [CONFIG] ~ [CI_AI51 Type] or [<EXPANSION>] ~ [CONFIG] ~ [CI_AI52 Type] respectively.

[Pulses/volume]: (Pulses per volume)

Default	1.00
Minimum	0.1
Maximum	655.35
Unit	p/v
Modbus Address	%mw394

If a pulse flow transducer is used, this screen sets the amount of pulses expected per the volume set in screen **[<EXPANSION>]** ~ **[SENSORS]** ~ **[Volume]**. See also **[<EXPANSION>]** ~ **[SENSORS]** ~ **[Flow Source]** for a description of scaling effects.

[Volume]: (Volume)

Default	1
Minimum	1
Maximum	65535
Unit	l, gal
Modbus Address	%mw396

If a pulse flow transducer is used, this screen sets the volume expected per the pulse quantity set in screen **[<EXPANSION>]** ~ **[SENSORS]** ~ **[Pulses/volume]**. See also **[<EXPANSION>]** ~ **[SENSORS]** ~ **[Flow Source]** for a description of scaling effects.

[Flow Units]: (Flow Units)

Default	Liters/s
Range	%, liters/s, liters/m, liters/h, Gallons/s, Gallons/m, Gallons/h
Modbus Address	%mw398

This screen sets the units for all other screens that display, or allow modification of, a flow rate.
See also **[<EXPANSION>]** ~ **[SENSORS]** ~ **[Flow Source]** for a description of scaling effects.

Note that if other unit than volume is selected, it will switch back to a volume unit.

[Flow Filter]: (Flow Filter)

Default	0
Minimum	0
Maximum	65535
Unit	sec
Modbus Address	%mw400

If a pulse flow transducer is used, this screen sets the filter time base. If the signal is of a reasonably high frequency, some instability may be present. This filter is used to dampen the rate of change of the derived flow rate.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

High Flow Filter values may cause long delays between flow rate change and the desired evasive action.

Failure to follow these instructions can result in death, serious injury or equipment damage.

[Temp Tx Min]: (Temperature Transducer Minimum)

Default	0
Minimum	-32767
Maximum	0
Unit	deg, Far
Modbus Address	%mw402

This screen is used to inform the system of the range of the transducer being used to measure temperature. If the transducer used is a 4-20 mA and -10 to +100 °C device, then -10 should be entered in this screen.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for temperature, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

[Temp Tx Max]: (Temperature Transducer Maximum)

Default	100
Minimum	0
Maximum	32767
Unit	deg, Far
Modbus Address	%mw404

This screen is used to inform the system of the range of the transducer being used to measure temperature. If the transducer used is a 4-20 mA and -10 to +100 °C device, then +100 should be entered in this screen.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for temperature, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [FLOW LMT] ~

[Activate Lim]: (Activate Limit)

Default	**[Disable]**
Range	**[Disable]** or **[Enable]**
Modbus Address	%mw406

This parameter enables or disables the flow limit function of the Water Solution, Multi-pump card.
If flow limiting is enabled and the measured flow increases to a level greater than **[<EXPANSION>]** ~ **[FLOW LIMIT]** ~ **[Flow Limit]**, the drive controller will immediately cease PID control and decelerate the motor at the flow limit rate set in screen **[<EXPANSION>]** ~ **[FLOW LIMIT]** ~ **[Flow Lmt Ramp]**. The motor will continue to decelerate until the measured flow is below **[Flow Limit]**, at which point the current motor speed will be maintained. The system will remain in flow limit until the measured flow is less than **[<EXPANSION>]** ~ **[FLOW LIMIT]** ~ **[Flow Lmt Reset]**, at which point the system will again revert to PID control.

See figure 13, page 48

[Flow Limit]: (Flow Limit)

Default	0.0
Minimum	**[Flo Lmt Reset]**
Maximum	32767
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw408

If the flow limit function is enabled, flow limiting action will be initiated when the measured flow increases to a level greater than that entered in this screen.

See figure 13, page 48

[Flo Lmt Reset]: (Flow Limit Reset)

Default	0.0
Minimum	0.0
Maximum	**[Flow Limit]**
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw410

If the flow limit function is enabled, flow limiting action will be terminated when the measured flow decreases to a level less than that entered in this screen.

See figure 13, page 48

[Flow Lmt Ramp]: (Flow Limit Ramp)

Default	10.0
Minimum	0.0
Maximum	999.9
Unit	sec
Modbus Address	%mw412

If the flow limit function is enabled, this is the rate at which the motor will be decelerated when the measured flow is above **[Flow Lmt]**

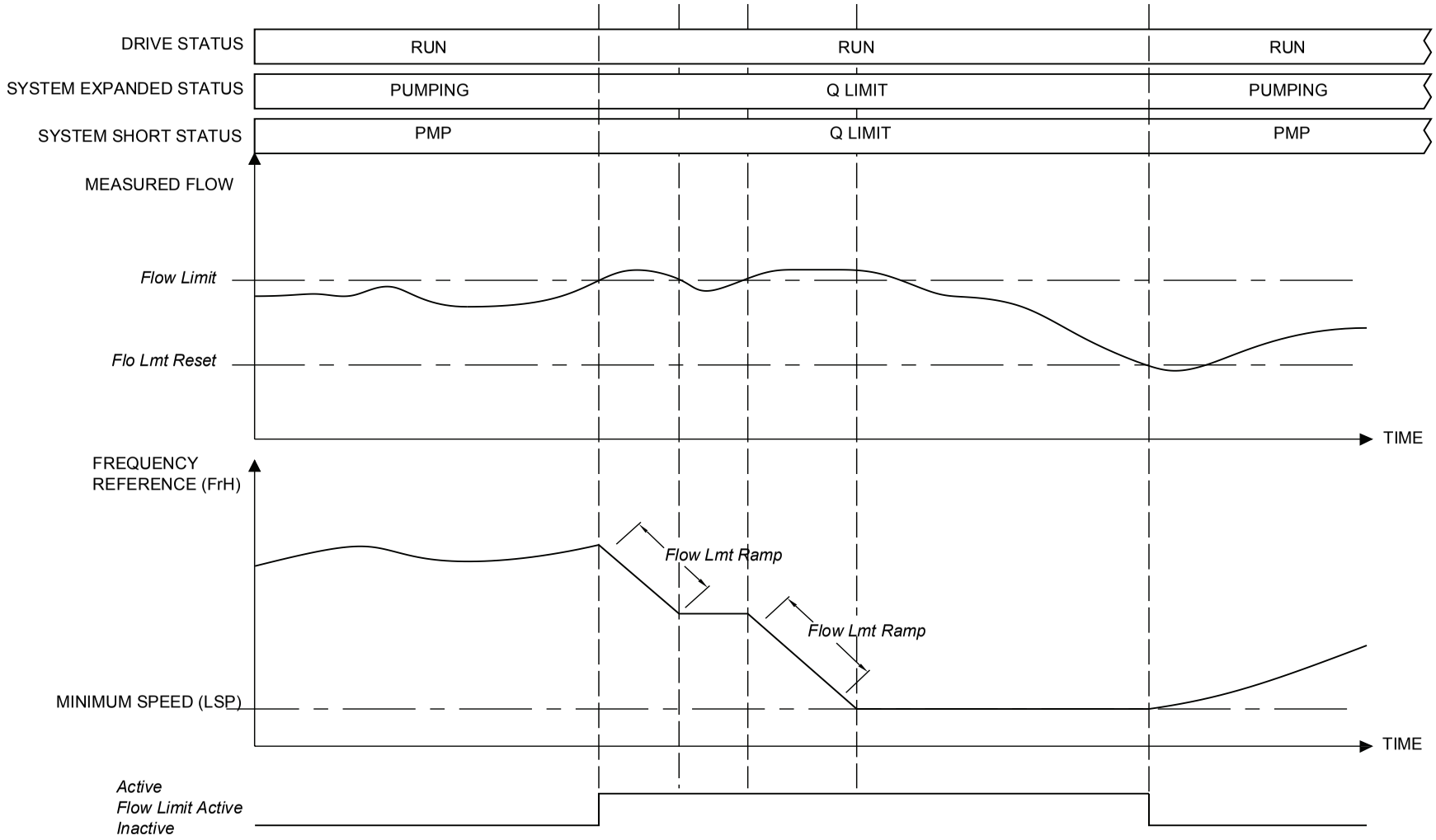
See figure 13, page 48

Parameter Descriptions

Flow Limit

The following diagram describes the Flow Limit.

Figure 13



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [PID] ~

[PID Reference]: (PID Reference)

Default	Local
Range	DRIVE_AI1, DRIVE_AI2, DRIVE_AI3, DRIVE_AI4, CI_AI1, CI_AI2 or LOCAL
Modbus Address	%mw414

This parameter is used to select the reference for the Water Solution, Multi-pump card PID.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for PID Reference, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

See figure 14, page 52

[PID Max Ref]: (PID Maximum Reference)

Default	3200.0
Minimum	0.0
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw416

This parameter sets the maximum setpoint that can ever be applied to the Water Solution, Multi-pump card PID. This can be used to reduce inadvertent operator error during adjustment of the PID setpoint. It can also be useful to limit the effects of flow compensation adjustments.

See figure 14, page 52

[PID Feedback]: (PID Feedback)

Default	DRIVE_AI2
Range	DRIVE_AI1, DRIVE_AI2, DRIVE_AI3, DRIVE_AI4, CI_AI1, or CI_AI2
Modbus Address	%mw418

This parameter is used to select the feedback for the Water Solution, Multi-pump card PID.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for PID feedback, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

See figure 14, page 52

[PID Gain]: (PID Gain)

Default	+1.40
Minimum	-100.00
Maximum	+100.00
Unit	x
Modbus Address	%mw420

This parameter sets the proportional gain of the custom PID controller.

See figure 14, page 52

[PID Integral]: (PID Integral)

Default	10.00
Minimum	0.00
Maximum	100.00
Unit	sec
Modbus Address	%mw422

This parameter sets the integral gain of the custom PID controller. See figure 14, page 52

[PID Deriv]: (PID Derivative)

Default	0.00
Minimum	0.00
Maximum	100.00
Unit	sec
Modbus Address	%mw424

This parameter sets the derivative gain of the custom PID controller.

See figure 14, page 52

[PID Accel]: (PID Acceleration)

Default	5.0
Minimum	0.0
Maximum	999.9
Unit	sec
Modbus Address	%mw426

This parameter sets the minimum time required for the PID controller to accelerate the motor from zero speed to motor rated frequency (FrS) when in PID control. This rate is used whenever the actual motor speed (rFr) is above the motor low speed (LSP) and PID control is active (i.e., not flow limiting, no fault conditions, and not stopping).

See figure 14, page 52

[PID Decel]: (PID Deceleration)

Default	5.0
Minimum	0.0
Maximum	999.9
Unit	sec
Modbus Address	%mw428

This parameter sets the minimum time required for the PID controller to decelerate the motor from motor rated frequency (FrS) to zero speed when in PID control. This rate is used whenever the actual motor speed (rFr) is above the motor low speed (LSP) and PID control is active, (i.e., not flow limiting and no fault conditions).

See figure 14, page 52

[Strt Acc Rate]: (Starting Acceleration Rate)

Default	3.0
Minimum	0.0
Maximum	999.9
Unit	sec
Modbus Address	%mw430

This parameter sets the time required for the system to accelerate the motor from zero speed to motor rated frequency (FrS). This rate is used whenever the actual motor speed (rFr) is below the motor low speed (LSP) setting and no fault conditions are present.

See figure 14, page 52

[Stp Dec Rate]: (Stopping Deceleration Rate)

Default	3.0
Minimum	0.0
Maximum	999.9
Unit	sec
Modbus Address	%mw432

This parameter sets the time required for the system to decelerate from motor rated frequency (FrS) to zero speed. This rate is used whenever a stop command is present. See figure 14, page 52

[Alt Reference]: (Alternative Reference)

Default	Local
Range	DRIVE_AI1, DRIVE_AI2, DRIVE_AI3, DRIVE_AI4, CI_AI1, CI_AI2 or LOCAL
Modbus Address	%mw434

This parameter is used to select the alternative reference for the Water Solution, Multi-pump card PID. This reference becomes active when drive digital input two (DRIVE_LI2) is active.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for PID Reference, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

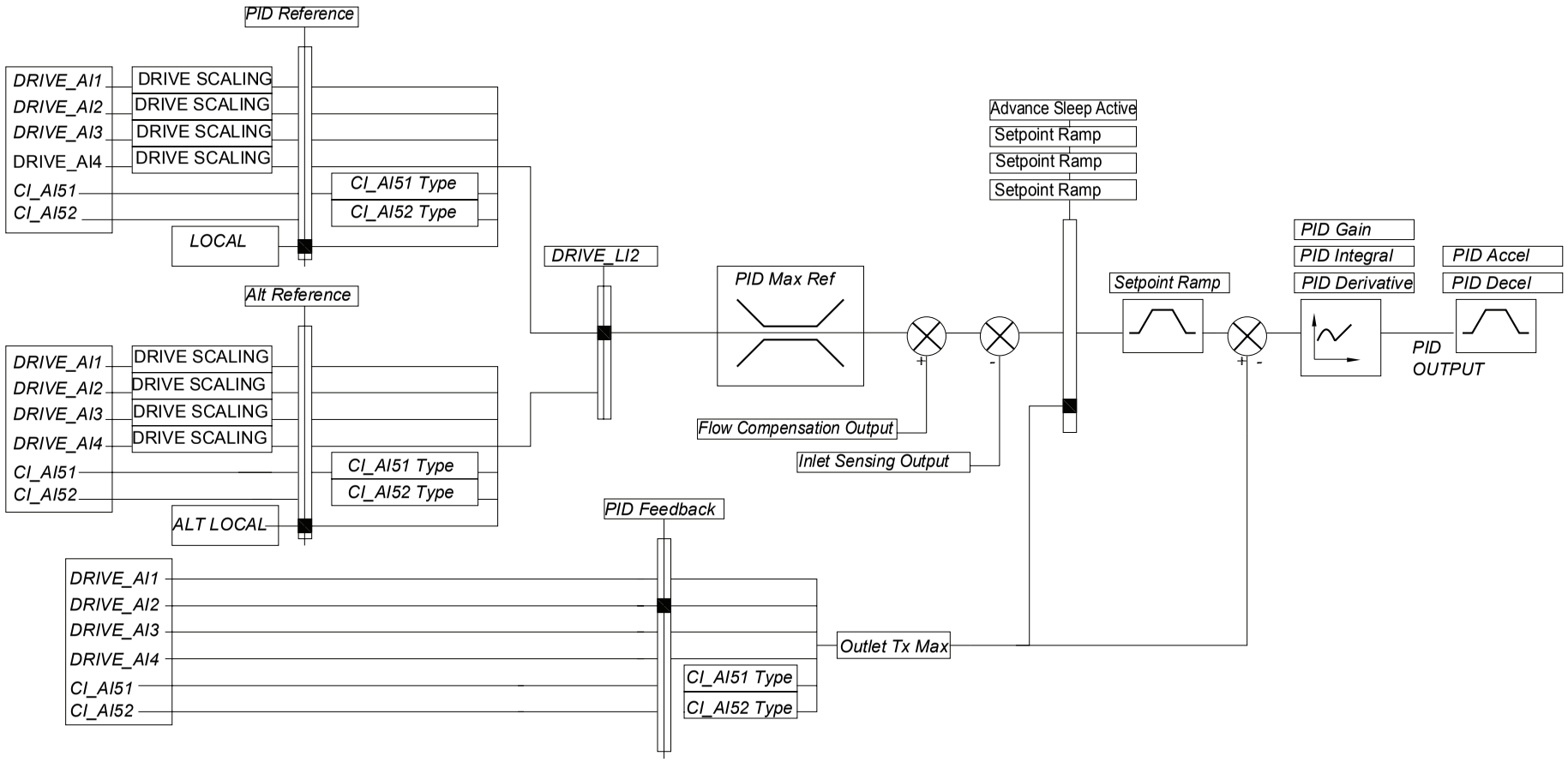
See figure 14, page 52

Parameter Descriptions

PID Schematic

The following diagram describes the PID control.

Figure 14



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [STAGE] ~

[Number of EXT]: (Number of External Pumps)

Default	0
Minimum	0
Maximum	3
Unit	pmp
Modbus Address	%mw436

This parameter sets the number of auxiliary pumps that are installed.

[Duty Sharing]: (Duty Sharing)

Default	Enable
Range	**[ON]** or **[OFF]**
Modbus Address	%mw438

If duty sharing is enabled and an auxiliary pump is required, the pump with the least amount of run hours will be started first. If an auxiliary pump must be destaged, the pump with the higher amount of run hours will be stopped first. If duty sharing is disabled, the pumps will be started and stopped numerically (i.e., 1 on, then 2 on, then 3 on; 3 off, then 2 off, then 1 off).

Parameter set **[<EXPANSION>]** ~ **[SAVED TIM]** ~ shows the saved run time hours for all pumps.

[Stage Mode]: (Stage Mode)

Default	Sp+Pr+Dly
Range	Sp+Pr+Dly, Sp+Pr, Sp+Dly, Sp Only, Pr+Dly, Pr Only
Modbus Address	%mw440

This parameter sets the permissives that must be met before an auxiliary pump is started.

Sp+Pr+Dly	If this is selected, an auxiliary pump will not be staged until the speed of the variable speed pump is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Speed]**, the system error (setpoint - feedback) is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Error]**, and these two permissives have been true for longer than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Delay]**.
Sp+Pr	If this is selected, an auxiliary pump will not be staged until the speed of the variable speed pump is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Speed]** and the system error (setpoint - feedback) is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Error]**.
Sp+Dly	If this is selected, an auxiliary pump will not be staged until the speed of the variable speed pump is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Speed]** for longer than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Delay]**.
Sp Only	If this is selected an auxiliary pump will not be staged until the variable speed pump is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Speed]**.
Pr+Dly	If this is selected, an auxiliary pump will not be staged until the system error (setpoint - feedback) is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Error]** for longer than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Delay]**.
Pr Only	If this is selected, an auxiliary pump will not be staged until the system error (setpoint - feedback) is greater than **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Error]**.

See figure 15, page 56

[Stage Speed]: (Stage Speed)

Default	50
Minimum	**[Stage Byp Spd]**
Maximum	HSP
Unit	Hz
Modbus Address	%mw442

This parameter sets the minimum speed of the variable speed pump before an auxiliary pump is started, if **[Speed]** is one of the stage permissives selected in screen **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Mode]**.

See figure 15, page 56

[Stage Error]: (Stage Error)

Default	0.0
Minimum	0.0
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw444

This parameter sets the required system error (setpoint - feedback) before an auxiliary pump is started, if **[Error]** is one of the stage permissives selected in screen **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Mode]**.

See figure 15, page 56

[Stage Delay]: (Stage Delay)

Default	5
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw446

This parameter sets the required delay after a selected permissive has been met before an auxiliary pump is started, if delay is one of the stage permissives selected in screen **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Mode]**.

See figure 15, page 56

[Stage Byp Spd]: (Stage Bypass Speed)

Default	50
Minimum	LSP
Maximum	Stage Speed
Unit	Hz
Modbus Address	%mw448

Immediately before staging an auxiliary pump, the variable speed pump will decelerate to the speed entered in this screen and will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stg Byp Time]**. After this time, the system reverts back to PID control.

See figure 15, page 56

[Stg Byp Time]: (Stage Bypass Time)

Default	5
Minimum	1
Maximum	3600
Unit	sec
Modbus Address	%mw450

Immediately before staging an auxiliary pump, the variable speed pump will decelerate to the speed entered in screen **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Byp Spd]**, and will remain at this speed for the time entered in **[Stg Byp Time]**. After this time, the system reverts back to PID control.

See figure 15, page 56

[Stage Offset]: (Stage Offset)

Default	0
Minimum	0
Maximum	**[Stage Speed]** - **[Stage Byp Spd]**
Unit	Hz
Modbus Address	%mw452

Immediately before staging an auxiliary pump, the variable speed pump will decelerate to the speed entered in screen **[<EXPANSION>]** ~ **[STAGE]** ~ **[Stage Byp Spd]**. On commencement of deceleration, the auxiliary pump is not necessarily staged immediately. If desired, the system can wait until the variable speed pump has slowed to **[Stage Byp Spd]** + the value entered in **[Stage Offset]**.
This setting is typically used when the external pumps are controlled by a soft starter.

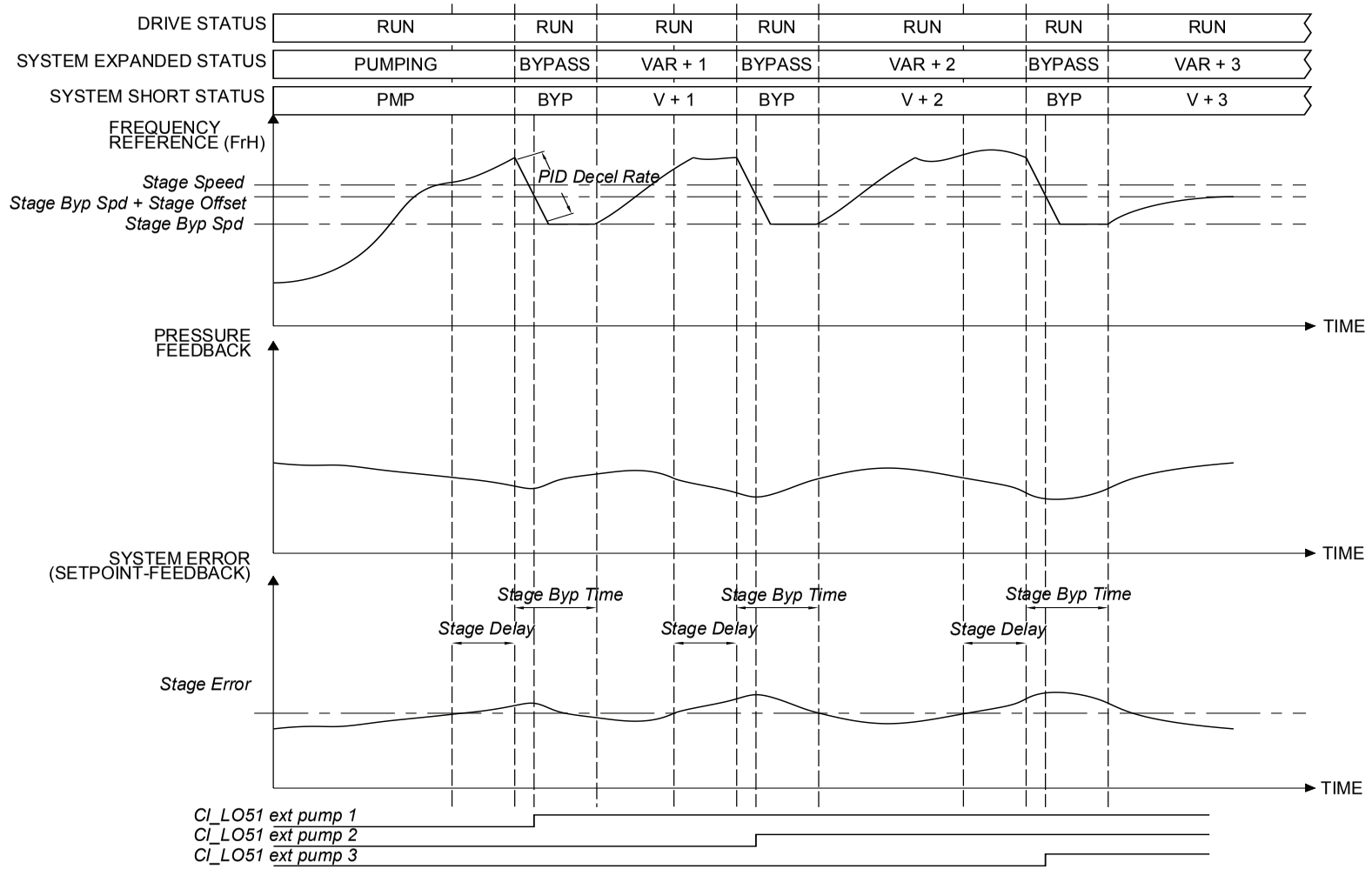
See figure 15, page 56

Parameter Descriptions

Stage

The following diagram describes pump staging.

Figure 15



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [DESTAGE] ~

[Destage Mode]: (Destage Mode)

Default	Sp+Pr+Dly
Range	Sp+Pr+Dly, Sp+Pr, Sp+Dly, Sp Only, Pr+Dly, Pr Only
Modbus Address	%mw454

This parameter sets the permissives that must be met before an auxiliary pump is stopped.

Sp+Pr+Dly	If this is selected, an auxiliary pump will not be destaged until the speed of the variable speed pump is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Speed]**, the system error (setpoint - feedback) is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Error]**, and these two permissive have been true for longer than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Delay]**.
Sp+Pr	If this is selected, an auxiliary pump will not be destaged until the speed of the variable speed pump is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Speed]** and the system error (setpoint - feedback) is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Error]**.
Sp+Dly	If this is selected, an auxiliary pump will not be destaged until the speed of the variable speed pump is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Speed]** for longer than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Delay]**.
Sp Only	If this is selected, an auxiliary pump will not be destaged until the speed of the variable speed pump is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Speed]**.
Pr+Dly	If this is selected, an auxiliary pump will not be destaged until the system error (setpoint - feedback) is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Error]** for longer than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Delay]**.
Pr Only	If this is selected, an auxiliary pump will not be destaged until the system error (setpoint - feedback) is less than **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Error]**.

See figure 16, page 59

[Destage Speed]: (Destage Speed)

Default	40
Minimum	LSP
Maximum	**[Dstge Byp Sp]**
Unit	Hz
Modbus Address	%mw456

This parameter sets the speed of the variable speed pump before an auxiliary pump is stopped, if **[Speed]** is one of the destage permissives selected in screen **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Mode]**.

See figure 16, page 59

[Destage Error]: (Destage Error)

Default	0.0
Minimum	-3276.7
Maximum	0
Unit	%, kPa, bar, psi
Modbus Address	%mw458

This parameter sets the required system error (setpoint - feedback) before an auxiliary pump is stopped, if **[Error]** is one of the destage permissives selected in screen **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Mode]**.

See figure 16, page 59

[Destage Delay]: (Destage Delay)

Default	1
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw460

This parameter sets the required delay, after selected permissives hare been met, before an auxiliary pump is stopped, if delay is one of the destage permissives selected in screen **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Destage Mode]**. See figure 16, page 59

[Dstge Byp Sp]: (Destage Bypass Speed)

Default	40
Minimum	**[Destage Speed]**
Maximum	HSP
Unit	Hz
Modbus Address	%mw462

Immediately before destaging an auxiliary pump, the variable speed pump will accelerate to the speed entered in this screen and will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Dstg Byp Time]**. After this time, the system reverts back to PID control.

See figure 16, page 59

[Dstg Byp Time]: (Destage Bypass Time)

Default	5
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw464

Immediately before destaging an auxiliary pump, the variable speed pump will accelerate to the speed entered in screen **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Dstge Byp Sp]** and will remain at this speed for the duration entered in **[Dstg Byp Time]**. After this time, the system reverts back to PID control.

See figure 16, page 59

[Dstg Offset]: (Destage Offset)

Default	0
Minimum	0
Maximum	250
Unit	Hz
Modbus Address	%mw466

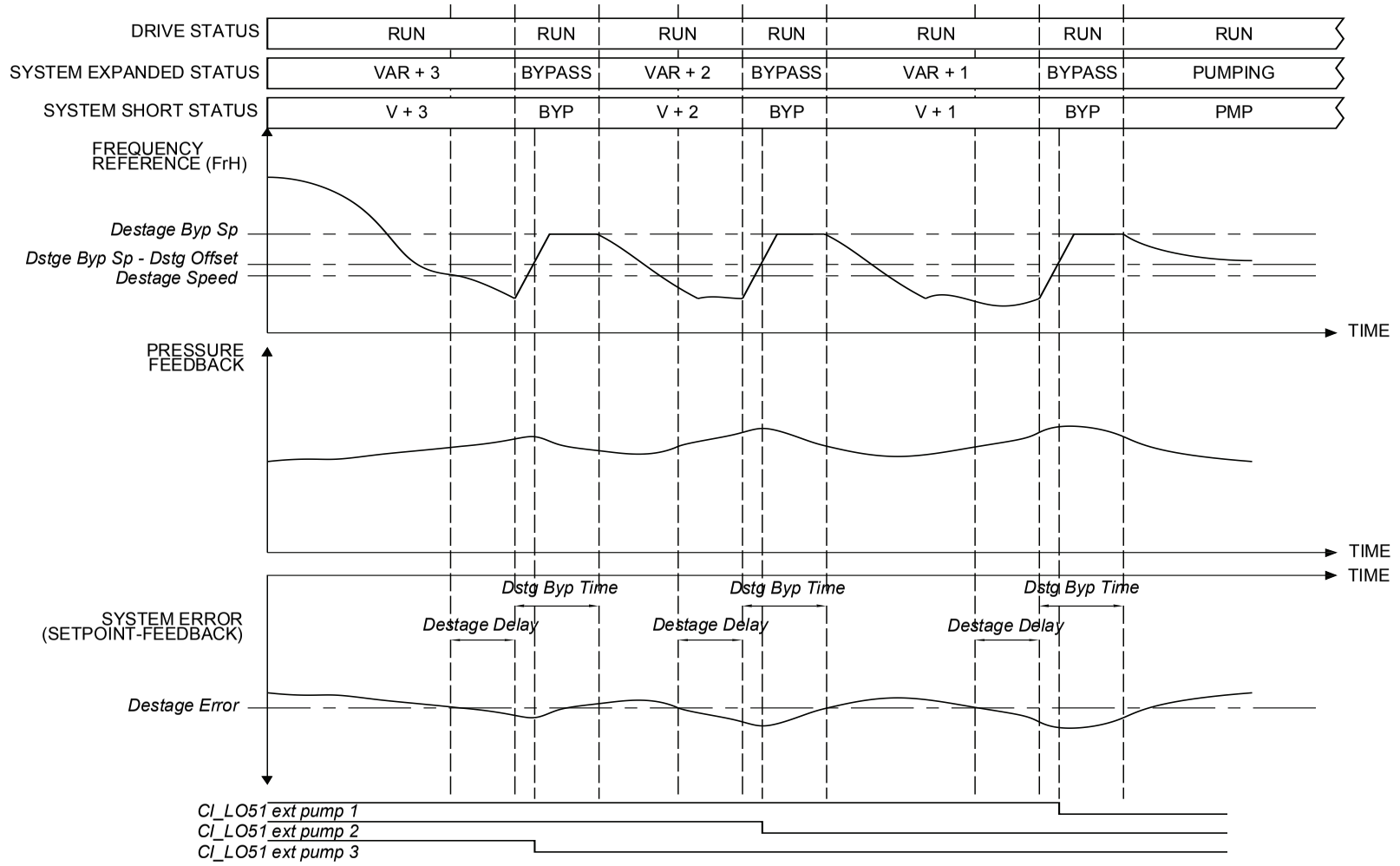
Immediately prior to destaging an auxiliary pump, the variable speed pump will accelerate to the speed entered in screen **[<EXPANSION>]** ~ **[DESTAGE]** ~ **[Dstge Byp Sp]**. On commencement of acceleration, the auxiliary pump is not necessarily destaged immediately. If desired, the system can wait until the variable speed pump has risen to **[Dstge Byp Sp]** (the value entered in this screen).

See figure 16, page 59

Destage

The following diagram describes pump destaging.

Figure 16



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [JOCKEY] ~

[Jockey]: (Jockey)

Default	**[Disable]**
Range	**[Disable]** or **[Jockey]** or **[Priming]**
Modbus Address	%mw468

This parameter enables or disables the Jockey function of the Water Solution, Multi-pump card.
The Jockey function requires a pump to be controlled via digital output CI_LO56. The Jockey pump maintains the setpoint pressure during times of low demand.

See figure 17, page 61

[Jky Stop P]: (Jockey Stop Pressure)

Default	0
Minimum	**[Jky On Press]**
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw470

If the Jockey function is enabled, digital output relay CI_LO56 will switch on when the measured pressure falls below the value set in screen **[<EXPANSION>]** ~ **[JOCKEY]** ~ **[Jky Start P]** for longer than the time entered in screen **[<EXPANSION>]** ~ **[JOCKEY]** ~ **[Jky On Delay]**. The Jockey pump will remain on until the pressure rises above the value entered in **[Jky Stop P]**, or until the variable speed pump starts due to a higher demand than that which the Jockey pump can meet.

See figure 17, page 61

[Jky Start P]: (Jockey Start Pressure)

Default	0
Minimum	0
Maximum	**[Jky Off Press]**
Unit	%, kPa, bar, psi
Modbus Address	%mw472

If the Jockey function is enabled, digital output relay CI_LO56 will switch on when the measured pressure falls below the value entered in this screen for longer than the time entered in screen **[<EXPANSION>]** ~ **[JOCKEY]** ~ **[Jky On Delay]**. The jockey pump will remain on until the pressure rises above the value entered in screen **[<EXPANSION>]** ~ **[JOCKEY]** ~ **[Jky Stop P],** or until the variable speed pump starts due to a higher demand than that which the Jockey pump can meet.

See figure 17, page 61

[Jky On Delay]: (Jockey On Delay)

Default	0
Minimum	0
Maximum	3600
Unit	sec
Modbus Address	%mw474

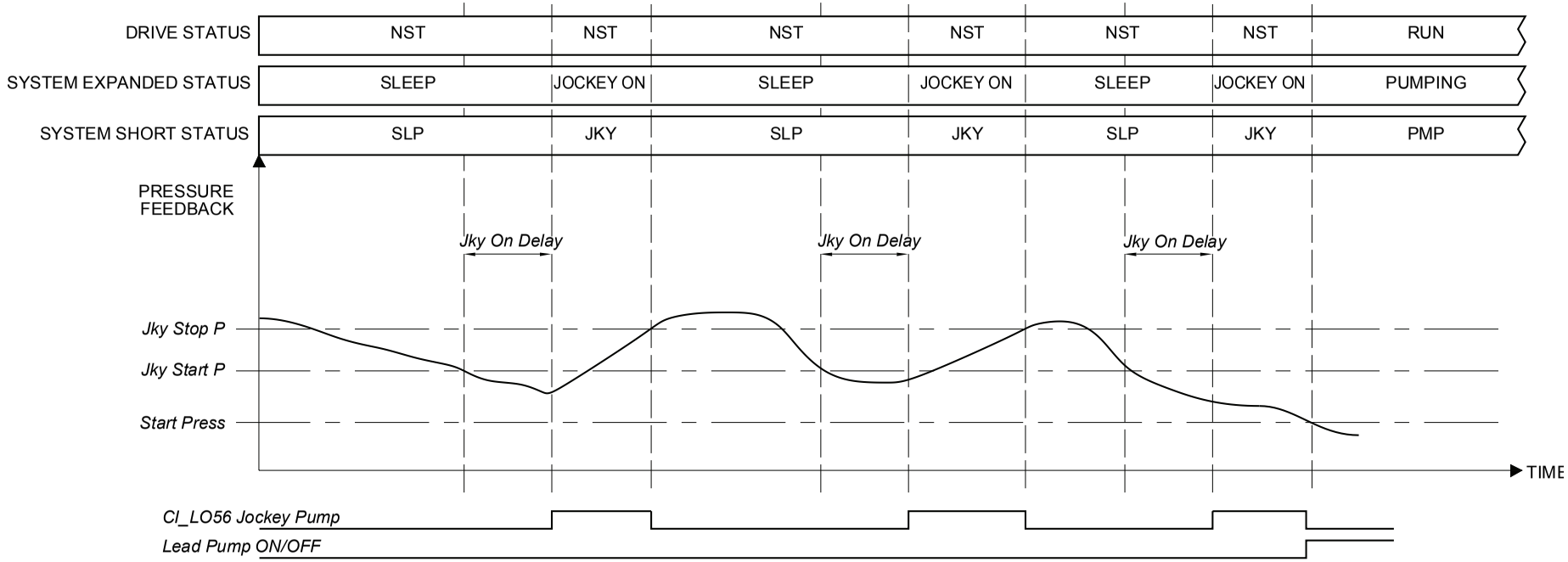
If the Jockey function is enabled, digital output relay CI_LO56 will switch on when the measured pressure falls below the value entered in screen **[<EXPANSION>]** ~ **[JOCKEY]** ~ **[Jky Start P]** for longer than the time entered in **[Jky On Delay]**. The jockey pump will remain on until the pressure rises above the value entered in screen **[<EXPANSION>]** ~ **[JOCKEY]** ~ **[Jky Stop P]**, or until the variable speed pump starts due to a higher demand than that which the Jockey pump can meet.

See figure 17, page 61

Jockey

The following diagram describes the Jockey function.

Figure 17



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [RUN TIMES] ~

[Timed Pumping]: (Timed Pumping)

Default	[Disable]
Range	[Disable] or [Enable]
Modbus Address	%mw476

This parameter enables or disables the [Run Times] function of the Water Solution, Multi-pump card.
If disabled, the system will run whenever start permissives are met. If enabled, the system will only run during the times set in the following screens. For example, if the following values are entered in the following screens:

[<EXPANSION>] ~ [RUN TIMES] ~ [Start Hours] = 19
[<EXPANSION>] ~ [RUN TIMES] ~ [Start Mins] = 0
[<EXPANSION>] ~ [RUN TIMES] ~ [Stop Hours] = 8
[<EXPANSION>] ~ [RUN TIMES] ~ [Stop Mins] = 0

the system will only run between 19:00 hours (7pm) and 08:00 hours (8am). At all other times the system will be off.

See figure 18, page 64

[Start Hours]: (Start Hours)

Default	0
Minimum	0
Maximum	23
Unit	Hrs
Modbus Address	%mw478

This screen sets the start hours.

See figure 18, page 64

[Start Mins]: (Start Minutes)

Default	0
Minimum	0
Maximum	59
Unit	Min
Modbus Address	%mw480

This screen sets the start minutes.

See figure 18, page 64

[Stop Hours]: (Stop Hours)

Default	0
Minimum	0
Maximum	23
Unit	Hrs
Modbus Address	%mw482

This screen sets the stop hours.

See figure 18, page 64

[Stop Mins]: (Stop Minutes)

Default	0
Minimum	0
Maximum	59
Unit	Min
Modbus Address	%mw484

This screen sets the stop minutes.

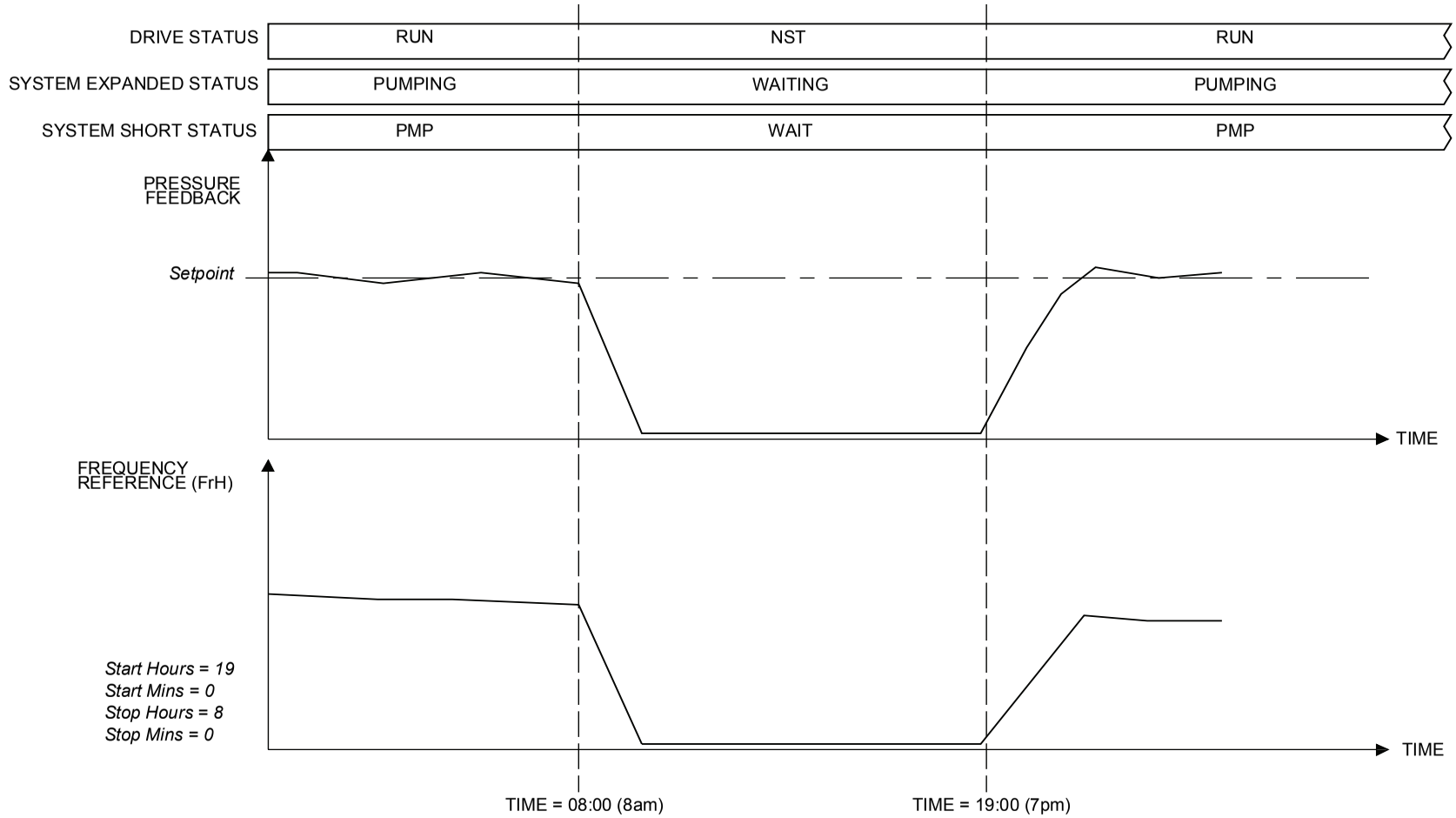
See figure 18, page 64

Parameter Descriptions

Run Times

The following diagram describes the Run Times function.

Figure 18



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [NIGHT&DAY] ~

[Night & Day]: (Night And Day)

Default	[Enable]
Range	[Enable] or [Disable]
Modbus Address	%mw486

This parameter enables or disables the Night and Day function of the Water Solution, Multi-pump card.
If enabled, the system will enter Night and Day mode during the times set in the following screens. For example, if the following values are entered in the following screens:

[<EXPANSION>] ~ [NIGHT&DAY] ~ [Start Hours] = 19
[<EXPANSION>] ~ [NIGHT&DAY] ~ [Start Mins] = 0
[<EXPANSION>] ~ [NIGHT&DAY] ~ [Stop Hours] = 8
[<EXPANSION>] ~ [NIGHT&DAY] ~ [Stop Mins] = 0

the system will enter Night and Day mode between 19:00 hours (7pm) and 08:00 hours (8am). At all other times the system will operate normally.
When in Night and Day mode, the system behaves similarly to the Jockey function, but uses the variable speed pump to maintain pressure at times of low demand. The system does this by turning the variable speed pump on and running it at a fixed speed until the pressure feedback increases.

When in Night and Day mode, the variable speed pump will start whenever the feedback pressure falls below the value entered in screen [<EXPANSION>] ~ [NIGHT&DAY]~ [N&D Start P]. The variable speed pump will run at the speed entered in screen [<EXPANSION>] ~ [NIGHT&DAY] ~ [N&D Speed] until the feedback pressure is greater than that entered in screen [<EXPANSION>] ~ [NIGHT&DAY] ~ [N&D Stop P]. There are two scenarios which will cause the system to exit the Night And Day mode:

1 After the pump has run for the time entered in screen [<EXPANSION>] ~ [NIGHT&DAY] ~ [Measure Time], the feedback pressure is noted and compared to the start pressure. If the pressure has risen, the pump will continue to run and a comparison will be made periodically (the interval defined by [Measure Time]). If at any time the pressure decreases from the previous value, the system will assume a high demand, exit the Night And Day mode, and behave as a standard variable speed pump.

2 If cycling is sensed, the system will assume a high demand, exit the Night And Day mode, and behave as a standard variable speed pump. Cycling is sensed when (time stopped/(time running + time stopped) *100) is less than the value entered in [<EXPANSION>] ~ [NIGHT&DAY] ~ [Cyclic Ratio]. If a value of 50 is entered as the cyclic ratio, the system will sense cycling if the pump is on for longer than it is off (high demand).

Once the system has exited the Night And Day mode, it will behave as a normal system. However, the sensed high demand may decrease and the system may enter the sleep state. If this happens and the system has been in the sleep state for longer than the time entered in screen [<EXPANSION>] ~ [NIGHT&DAY] ~ [Restart Time], low demand is sensed and the system will re-enter the Night And Day mode, as long as it is still within the Night And Day time permissive.

See figure 19, page 68

[Start Hours]: (Start Hours)

Default	0
Minimum	0
Maximum	23
Unit	Hrs
Modbus Address	%mw488

This screen sets the start hours.

See figure 19, page 68

[Start Mins]: (Start Minutes)

Default	0
Minimum	0
Maximum	59
Unit	Min
Modbus Address	%mw490

This screen sets the start minutes.
See figure 19, page 68

[Stop Hours]: (Stop Hours)

Default	0
Minimum	0
Maximum	23
Unit	Hrs
Modbus Address	%mw492

This screen sets the stop hours.

See figure 19, page 68

[Stop Mins]: (Stop Minutes)

Default	0
Minimum	0
Maximum	59
Unit	Min
Modbus Address	%mw494

This screen sets the stop minutes.

See figure 19, page 68

[N&D Start P]: (Start Pressure)

Default	0
Minimum	0
Maximum	**[N&D Stop P]**
Unit	%, kPa, bar, psi
Modbus Address	%mw496

If the Night and Day function is enabled and active, the variable speed pump will start when the feedback pressure falls below the value entered in this screen. See figure 19, page 68

[N&D Stop P]: (Stop Pressure)

Default	0
Minimum	N&D Start P
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw498

If the night and day function is enabled and active, the variable speed pump will stop when the feedback pressure rises above the value entered in this screen.

See figure 19, page 68

[Measure Time]: (Measure Time)

Default	0
Minimum	0
Maximum	32767
Unit	sec
Modbus Address	%mw500

Each time the drive controller starts when the Night And Day function is active, the feedback pressure is noted. Periodically, at the interval set in this screen, the feedback is again noted. If the pressure has risen, the system remains in Night And Day mode. But if the pressure has dropped, it is assumed that the demand is greater than that which the Night And Day function can supply, and the system leaves the Night And Day function and reverts to normal operation.

See figure 19, page 68

[N&D Speed]: (Night and Day Speed)

Default	0
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw502

If the Night And Day function is enabled and active, the variable speed pump will run at the value entered in this screen when the pressure falls below that entered in screen **[<EXPANSION>]** ~ **[NIGHT&DAY]** ~ **[N&D Start P]**.

See figure 19, page 68

[Cyclic Ratio]: (Cyclic Ratio)

Default	50
Minimum	0
Maximum	32767
Unit	%
Modbus Address	%mw504

If cycling is sensed, the system will assume a high demand and exit the Night and Day mode. The system will then behave as a standard pumping system. Cycling is sensed when (time stopped/(time running + time stopped) *100) is less than the value entered in this screen. If a value of 50 is entered in this screen, the system will sense cycling if the pump is on for longer than it is off (high demand).

See figure 19, page 68

[Restart Time]: (Restart Time)

Default	90
Minimum	0
Maximum	32767
Unit	sec
Modbus Address	%mw506

Once the system has exited the Night and Day mode, the system behaves as a normal pump system. However the sensed high demand may decrease and the system may enter the sleep state. If this happens and the system has been in the sleep state for longer than the time entered in this screen, low demand is sensed and the system will re-enter the Night And Day mode as long as it is still within the Night and Day time permissive.

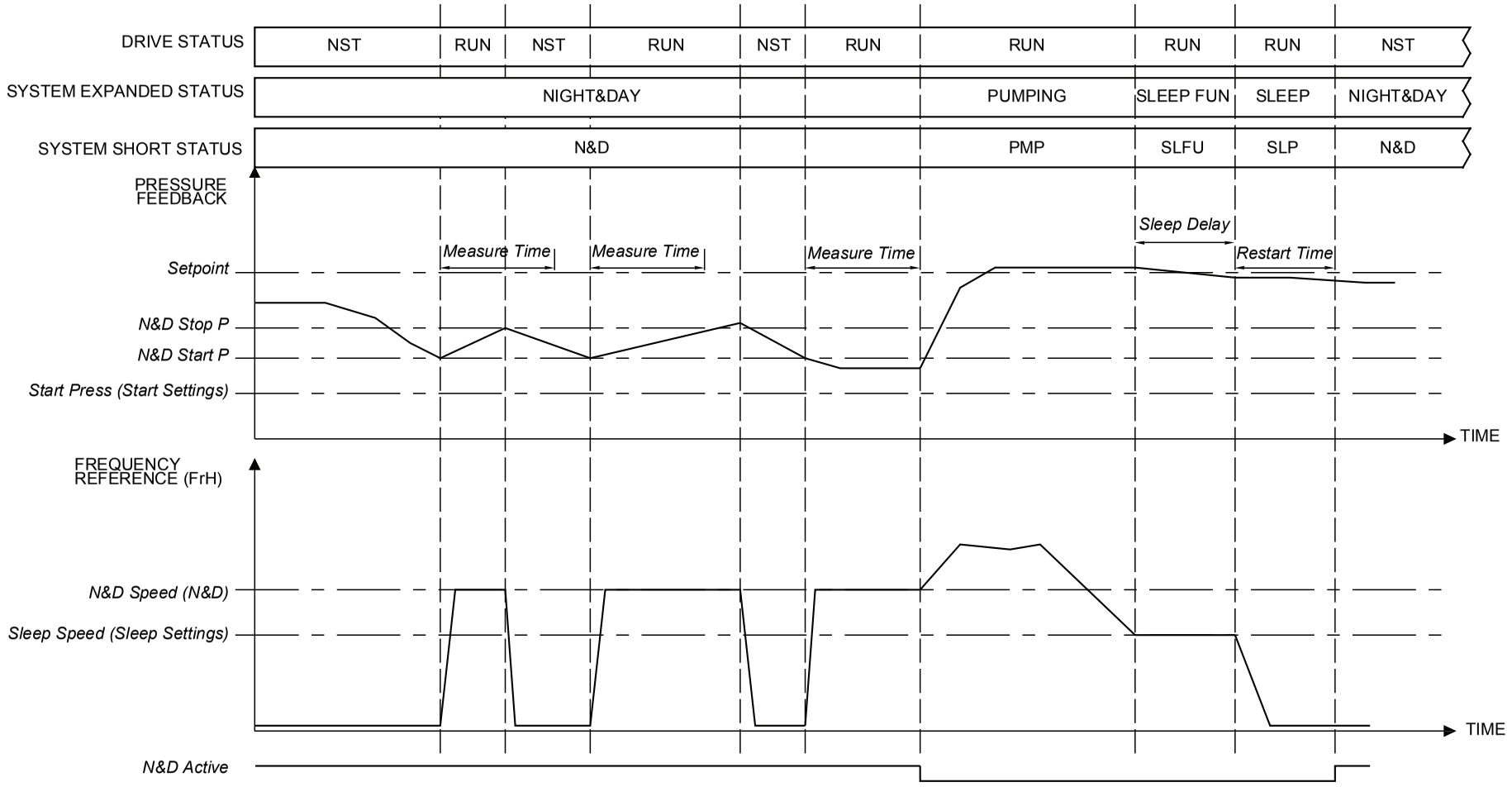
See figure 19, page 68

☞ Note that the internal clock does not automatically switch to daylight saving time.

Night & Day

The following diagram describes Night and Day function.

Figure 19



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [FLOW COMP] ~

[Comp Select]: (Compensation Select)

Default	[None]
Range	[None], [FlowComp] or [FixedComp]
Modbus Address	%mw508

This parameter sets the type of flow compensation the system should use. If none is selected, no compensation occurs regardless of the flow or number of external pumps running.

If [FlowComp] is selected, screens [<EXPANSION>] ~ [FLOW COMP] ~ [Known Flow] and [<EXPANSION>] ~ [FLOW COMP] ~ [Press Drop] become relevant. All other screens in this sub-menu become irrelevant. For [FlowComp] to work, a flow meter must be installed and calibrated correctly. The [FlowComp] algorithm uses the Hazen-Williams calculation, but requires two measured values to be entered. These are a known flow, preferably near maximum system demand, and the measured pressure drop at the point you wish compensation is correcting for. These are entered in screens [<EXPANSION>] ~ [FLOW COMP] ~ [Known Flow] and [<EXPANSION>] ~ [FLOW COMP] ~ [Press Drop] respectively.

See figure 20, page 71

[Known Flow]: (Known Flow)

Default	0.00
Minimum	0.00
Maximum	327.67
Unit	%, l/s, l/m, l/h, g/s, g/m, g/h
Modbus Address	%mw510

If [FlowComp] is selected as the method of compensation in screen [<EXPANSION>] ~ [FLOW COMP] ~ [Comp Select], then the algorithm requires a measured flow rate and the measured pressure drop at the point compensation is correcting for.

See figure 20, page 71

[Press Drop]: (Pressure Drop)

Default	0.0
Minimum	0.0
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw512

If [FlowComp] is selected as the method of compensation in screen [<EXPANSION>] ~ [FLOW COMP] ~ [Comp Select], then the algorithm requires a measured flow rate and the measured pressure drop at the point compensation is correcting for.

See figure 20, page 71

[Var Comp]: (Variable Speed Pump Compensation)

Default	0.00
Minimum	0.00
Maximum	327.67
Unit	%, kPa, bar, psi
Modbus Address	%mw514

If [FixedComp] is selected as the method of compensation in screen [<EXPANSION>] ~ [FLOW COMP] ~ [Comp Select], the system will compensate for flow based first on the variable speed pump and then on the number of external pumps that are running. The value entered in this screen is added to the applied setpoint linearly from minimum speed (LSP) to maximum speed (HSP). That is, if the following values are entered:
LSP = 30 Hz
HSP = 50 Hz
Var Comp = 1 bar
At 30 Hz, no compensation is made; at 40 Hz, 0.5 bar is added to the applied setpoint; and at 50 Hz, 1.0 bar is added to the applied setpoint.

See figure 21, page 72

[Ext 1 Comp]: (Fixed one Compensation)

Default	0.00
Minimum	0.00
Maximum	327.67
Unit	%, kPa, bar, psi
Modbus Address	%mw516

If **[FixedComp]** is selected as the method of compensation in screen **[<EXPANSION>]** ~ **[FLOW COMP]** ~ **[Comp Select]**, the system will compensate for flow based first on the variable speed pump and then on the number of external pumps that are running. The value entered in this screen is added to the applied setpoint when one external pump is required to run. The total compensation would be:

(Var Comp* ((Actual Speed-LSP)/ (HSP-LSP))) + Fixed1 Comp

See figure 21, page 72

[Ext 2 Comp]: (Fixed two Compensation)

Default	0.00
Minimum	0.00
Maximum	327.67
Unit	%, kPa, bar, psi
Modbus Address	%mw518

If **[FixedComp]** is selected as the method of compensation in screen **[<EXPANSION>]** ~ **[FLOW COMP]** ~ **[Comp Select]**, the system will compensate for flow based first on the variable speed pump and then on the number of external pumps that are running. The value entered in this screen is added to the applied setpoint when two external pumps are required to run. The total compensation would be:

(Var Comp* ((Actual Speed-LSP)/ (HSP-LSP))) + Fixed1 Comp + Fixed2 Comp

See figure 21, page 72

[Ext 3 Comp]: (Fixed three Compensation)

Default	0.00
Minimum	0.00
Maximum	327.67
Unit	%, kPa, bar, psi
Modbus Address	%mw520

If **[FixedComp]** is selected as the method of compensation in screen **[<EXPANSION>]** ~ **[FLOW COMP]** ~ **[Comp Select]**, the system will compensate for flow based first on variable speed pump and then on the number of external pumps that are running. The value entered in this screen is added to the applied setpoint when three external pumps are required to run. The total compensation would be:

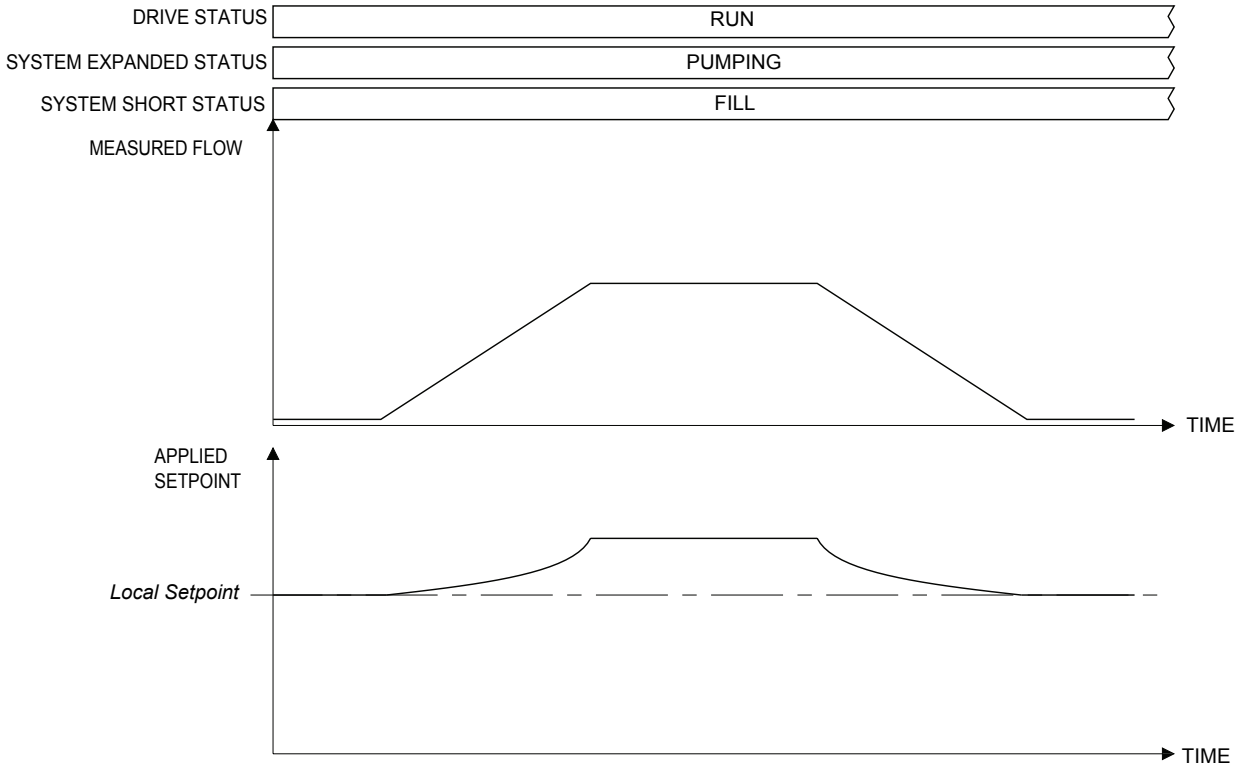
(Var Comp* ((Actual Speed-LSP)/ (HSP-LSP))) + Fixed1 Comp + Fixed2 Comp + Fixed3 Comp

See figure 21, page 72

Flow Compensation

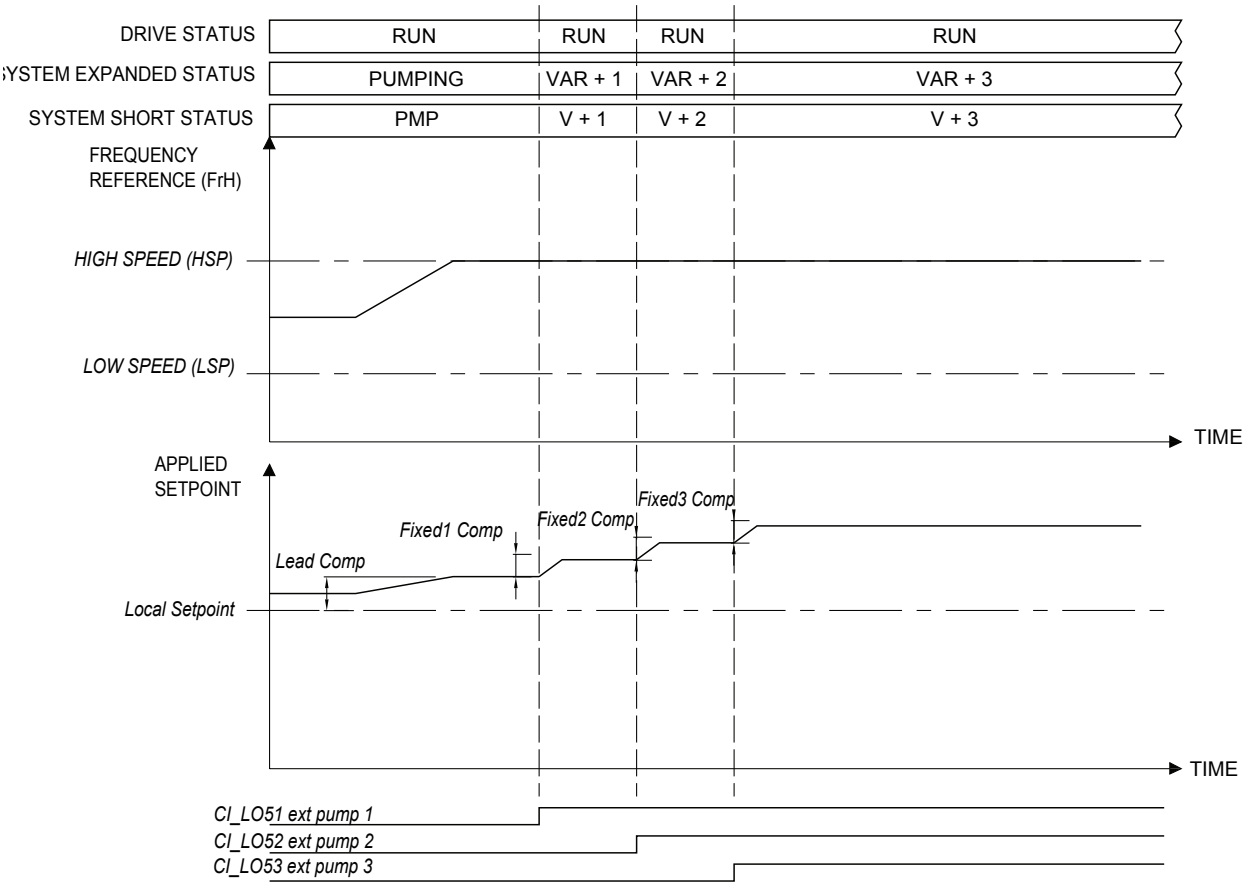
The following diagram describes Flow Compensation.

Figure 20



The following diagram describes Fixed Compensation.

Figure 21



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [INLET PRO] ~

[Inlet Protect]: (Inlet Detection)

Default	**[Disable]**
Range	**[Disable]** or **[Enable]**
Modbus Address	%mw522

This parameter enables or disables the Inlet Detection function of the Water Solution, Multi-pump card.
The inlet detection algorithm helps to protect the controlled pump from low inlet pressure. The algorithm does this by reducing the applied setpoint, which in turn reduces the output speed of the pump. For this function to be enabled, a pressure transducer must be installed on the suction side of the pump and connected to one of the available analog inputs.
The applied setpoint is reduced by the value entered in screen:

[<EXPANSION>] ~ **[INLET PROT]** ~ **[Max Comp]** linearly between the value entered in screen
[<EXPANSION>] ~ **[INLET PROT]** ~ **[Accept Press]** and
[<EXPANSION>] ~ **[INLET PROT]** ~ **[Unaccept Pres]**

For example, if the following settings are entered:

[Max Comp] = 2bar
[Accept Press] = 1bar
[Unaccept Pres] = 0bar

when the inlet feedback pressure is above 1 bar, no compensation is made. However, when the inlet feedback pressure is 0.5 bar, the applied setpoint is reduced by 1 bar. And when the inlet feedback is 0 bar, the applied setpoint is reduced by 2 bar. If in these circumstances the applied setpoint was in fact 2 bar, the applied setpoint would be reduced to 0 bar, and the system would reduce speed and enter the sleep state if configured for this.

See figure 22, page 75

[Inlet Source]: (Inlet Source)

Default	DRIVE_AI1
Range	DRIVE_AI1, DRIVE_AI2, DRIVE_AI3, DRIVE_AI4, CI_AI51, or CI_AI52
Modbus Address	%mw524

This parameter is used to select the Feedback for the Suction Pressure.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for Suction Pressure Feedback, it must be correctly configured in screens **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

See figure 22, page 75

[Accept Press]: (Acceptable Pressure)

Default	0.0
Minimum	**[Unaccept Pres]**
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw526

If the inlet pressure falls below this value, the inlet compensation algorithm becomes active. The applied setpoint is reduced by the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Max Comp]** linearly between the value entered in this screen (**[Accept Press]**) and screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Unaccept Pres]**

See figure 22, page 75

[Unaccept Pres]: (Unacceptable Pressure)

Default	0.0
Minimum	0.0
Maximum	**[Accept Press]**
Unit	%, kPa, bar, psi
Modbus Address	%mw528

If the inlet pressure falls below the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Accept Press]**, the inlet compensation algorithm becomes active. The applied setpoint is reduced by the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Max Comp]** linearly between the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Accept Press]** and the value entered in this screen (**[Unaccept Pres]**).

See figure 22, page 75

[Max Comp]: (Maximum Compensation)

Default	0.0
Minimum	0.0
Maximum	3276.7
Unit	%, kPa, bar, psi
Modbus Address	%mw530

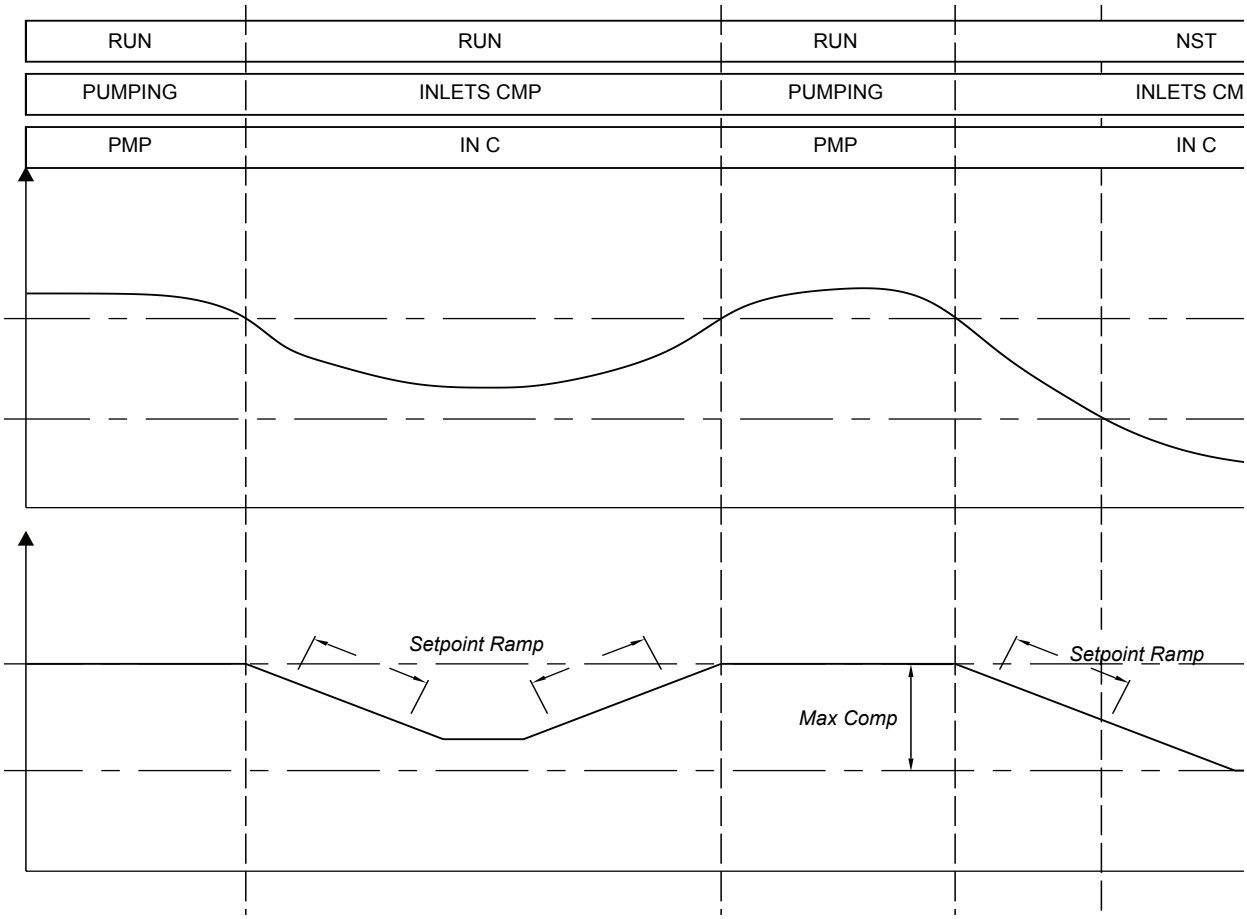
If the inlet pressure falls below the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Accept Press]**, the inlet compensation algorithm becomes active. The applied setpoint is reduced by the value entered in this screen linearly between the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Accept Press]** and the value entered in screen **[<EXPANSION>]** ~ **[INLET PROT]** ~ **[Unaccept Pres]**.

See figure 22, page 75

Inlet Detection

The following diagram describes the Inlet Detection.

Figure 22



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [ANTI JAM] ~

[Anti Jam]: (Anti Jam)

Default	**[Disable]**
Range	**[Disable]** or **[Enable]**
Modbus Address	%mw534

This parameter enables or disables the Anti Jam function of the Water Solution, Multi-pump card.

The Anti Jam function is used to dislodge any product or detritus that may be attached to the pump impeller. It may also be used to clear a blocked pipe or valve. The Anti Jam function works by rapidly accelerating and decelerating the pump. If triggered, the Anti Jam function will accelerate the motor to the speed set in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Fwd Speed]** at the rate entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[AJAM Accel]**. It will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Fwd Time]**. Once this time expires, the motor will be decelerated to the speed entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Rev Speed]** at the rate entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[AJAM Decel]**. It will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Rev Time]**. This forward reverse cycle will continue for the amount of times entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[No Cycles]**.

The Anti Jam function can be triggered in one of three ways, which are selected in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Trigger]**.

See figure 23, page 79

[Trigger]: (Trigger)

Default	**[DRIVE_LI1]**
Range	**[Current]**, **[DRIVE_LI1]** or **[Stopped]**
Modbus Address	%mw536

This parameter is used to select the trigger condition to instigate an Anti Jam cycle.
- If current is selected and the Anti Jam function is enabled, a cycle will begin when the motor current is above the value entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Current]** for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Cur Time]**.
- If **[DRIVE_LI1]** is selected and the Anti Jam function is enabled, a cycle will begin on the rising edge of digital input **[DRIVE_LI1]** (the system must be at stop: LI51, LI52 and LI57 = 0).
- If **[Stopped]** is selected and the Anti Jam function is enabled, a cycle will begin after the system has stopped automatically (CI_LI57/auto run command is still true) for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Stop Time]**.

See figure 23, page 79

[No Cycles]: (Number of Cycles)

Default	10
Minimum	0
Maximum	999
Modbus Address	%mw538

If the Anti Jam function is enabled and a cycle has been triggered, the forward/reverse cycle will be repeated for the amount of times entered in this screen.

See figure 23, page 79

[Current]: (Current)

Default	3276.7
Minimum	0
Maximum	2 * Drive rated current
Unit	A
Modbus Address	%mw540

If **[Current]** is selected and the Anti Jam function is enabled, a cycle will begin when the motor current is above the value entered in this screen for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Cur Time]**.

See figure 23, page 79

[Cur Time]: (CurrentTime)

Default	30
Minimum	1
Maximum	32767
Unit	sec
Modbus Address	%mw542

If **[Current]** is selected and the Anti Jam function is enabled, a cycle will begin when the motor current is above the value entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Current]** for the time entered in this screen.

See figure 23, page 79

[Stop Time]: (Stop Time)

Default	10
Minimum	1
Maximum	32767
Unit	sec
Modbus Address	%mw544

If **[Stopped]** is selected and the Anti Jam function is enabled, a cycle will begin after the system has stopped automatically (CI_LI57/auto run command is still true) for the time entered in this screen.

See figure 23, page 79

[Fwd Speed]: (Forward Speed)

Default	0
Minimum	LSP
Maximum	HSP
Unit	Hz
Modbus Address	%mw546

If triggered, the Anti Jam function will accelerate the motor to the speed set in this screen at the rate entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[AJAM Accel]**. It will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Fwd Time]**.

See figure 23, page 79

[Fwd Time]: (Forward Time)

Default	1
Minimum	0
Maximum	32767
Unit	sec
Modbus Address	%mw550

If triggered, the Anti Jam function will accelerate the motor to the speed set in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Fwd Speed]** at the rate entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[AJAM Accel]**. It will remain at this speed for the time entered in this screen.

See figure 23, page 79

[Rev Speed]: (Reverse Speed)

Default	0
Minimum	-HSP
Maximum	-LSP
Unit	Hz
Modbus Address	%mw548

If triggered, the Anti Jam function will decelerate the motor to the speed set in this screen at the rate entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[AJAM Decel]**. It will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Rev Time]**.

See figure 23, page 79

[Rev Time]: (Reverse Time)

Default	1
Minimum	0
Maximum	32767
Unit	sec
Modbus Address	%mw552

If triggered, the Anti Jam function will decelerate the motor to the speed set in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Rev Speed]** at the rate entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[AJAM Decel]**. It will remain at this speed for the time entered in this screen.

See figure 23, page 79

[AJAM Accel]: (Anti Jam Acceleration)

Default	3.0
Minimum	0
Maximum	999.9
Unit	sec
Modbus Address	%mw554

If triggered, the Anti Jam function will accelerate the motor to the speed set in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Fwd Speed]** at the rate entered in this screen. It will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Fwd Time]**.

See figure 23, page 79

[AJAM Decel]: (Anti Jam Deceleration)

Default	3.0
Minimum	0
Maximum	999.9
Unit	sec
Modbus Address	%mw556

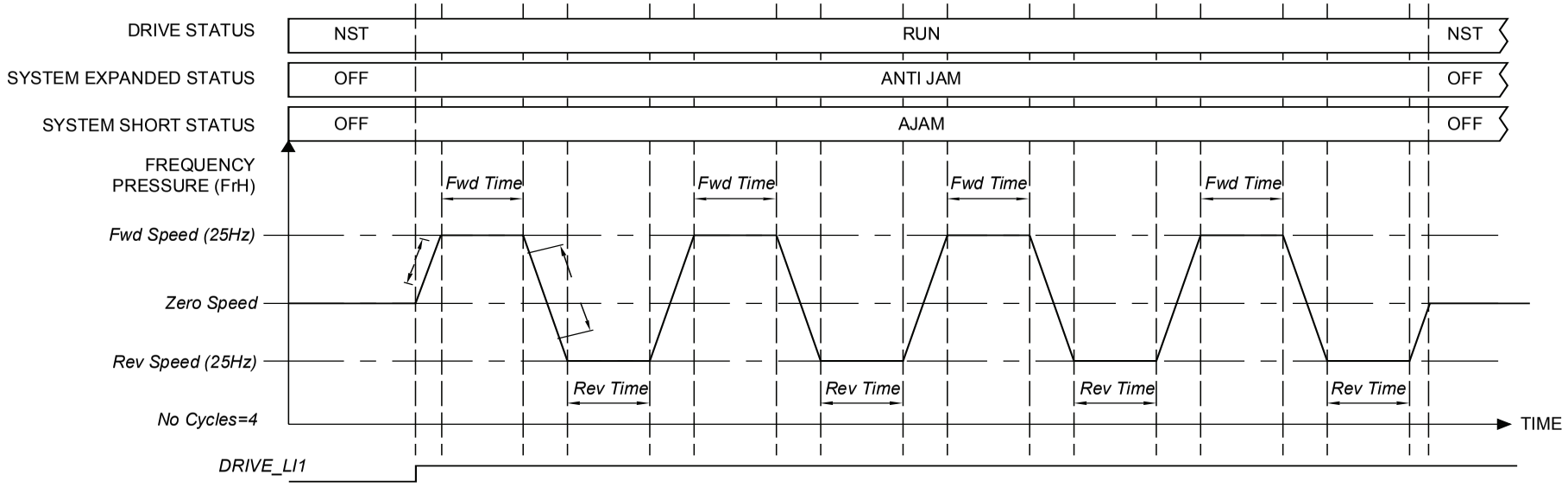
If triggered, the Anti Jam function will decelerate the motor to the speed set in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Rev Speed]** at the rate entered in this screen. It will remain at this speed for the time entered in screen **[<EXPANSION>]** ~ **[ANTI JAM]** ~ **[Rev Time]**.

See figure 23, page 79

Anti Jam

The following diagram describes the Anti Jam function.

Figure 23



[1.14 - WATER SOLUT.] ~ [<EXPANSION] > ~ [FROST PRO] ~

[Frost Protect]: (Frost Detection)

Default	**[Disable]**
Range	**[Disable]** or **[Enable]**
Modbus Address	%mw558

This parameter enables or disables the frost sensing function of the Water Solution, Multi-pump card. For the frost detection algorithm to work, a temperature transducer must be installed and connected to one of the available analog inputs.

If frost detection is enabled and the measured temperature falls below the value set in screen **[<EXPANSION>]** ~ **[FROST PRO]** ~ **[Alarm Temp]**, then digital output DRIVE_RELAY1 will be energized. The relay will only remain energized for as long as the temperature remains below the **[Alarm Temp]**.

If frost detection is enabled and the measured temperature falls below the value set in screen **[<EXPANSION>]** ~ **[FROST PRO]** ~ **[Protect Temp]**, then digital output DRIVE_RELAY2 will be energized and the variable speed pump will be started. The system will now operate as a normal system using the PID reference selected in screen **[<EXPANSION>]** ~ **[FROST PRO]** ~ **[Frost PID Ref]**.

The relay and system will remain on until the measured temp is above **[Protect Temp]** and either the reset button on the display is pressed or digital input CI_LI58 is energized to reset the system.

See figure 24, page 82

[Frost FB]: (Frost Feedback)

Default	DRIVE_AI1
Range	DRIVE_AI1, DRIVE_AI2, DRIVE_AI3, DRIVE_AI4, CI_AI51, or CI_AI52
Modbus Address	%mw560

This parameter is used to select the Feedback for the Water Solution, Multi-pump card frost detection temperature transducer.

Note that if one of the Water Solution, Multi-pump card analog inputs is used for Temperature Feedback, it must be correctly configured in screens
[<EXPANSION>] ~ **[CONFIG]** ~ **[CI_AI51 Type]** or **[<EXPANSION>]** ~ **[CONFIG]** ~ **[CI_AI52 Type]** respectively.

See figure 24, page 82

[Alarm Temp]: (Alarm Temperature)

Default	0.0
Minimum	-3276.7
Maximum	3276.7
Unit	deg, Far
Modbus Address	%mw562

If frost detection is enabled and the measured temperature falls below the value set in this screen, digital output DRIVE_RELAY1 will be energized. The relay will only remain energized for as long as the temperature remains below that entered in this screen.

See figure 24, page 82

[Protect temp]: (Trip Temperature)

Default	0.0
Minimum	-3276.7
Maximum	3276.7
Unit	deg, Far
Modbus Address	%mw564

If frost detection is enabled and the measured temperature falls below the value set in this screen, digital output DRIVE_RELAY2 will be energized and the variable speed pump will be started. The system will now operate as a normal system using the PID reference selected in screen **[<EXPANSION>]** ~ **[FROST PRO]** ~ **[Frost PID Ref]**. The relay and system will remain on until the measured temp is above **[Protect Temp]** and either the reset button on the display is pressed or digital input CI_LI58 is energized to reset the system.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Once activated, frost pumping can only be prematurely stopped by disabling the function in screen **[<EXPANSION>]** ~ **[FROST PRO]** ~ **[Frost Protect]**.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Note that the auto run command (CI_LI57) is not necessary for the frost sensing to operate.

See figure 24, page 82

[Actual temp]: (Actual Temperature)

Minimum	-3276.7
Maximum	3276.7
Unit	deg, Far
Modbus Address	%mw566

This screen is used to display the measured temperature.

[Frost PID Ref]: (Frost Detection PID Reference)

Default	0.0
Minimum	0
Maximum	6553.5
Unit	%, kPa, bar, psi
Modbus Address	%mw568

If frost detection is enabled and the measured temperature falls below the value set in screen **[<EXPANSION>]** ~ **[FROST PRO]** ~ **[Protect Temp]**, digital output DRIVE_RELAY2 will be energized and the variable speed pump will be started. The system will now operate as a normal system using the PID reference selected in this screen. The relay and system will remain on until the measured temp is above **[Protect Temp]** and either the reset button on the display is pressed or digital input CI_LI58 is energized to reset the system.

Note that the auto run command (CI_LI57) is not necessary for the frost sensing to operate.

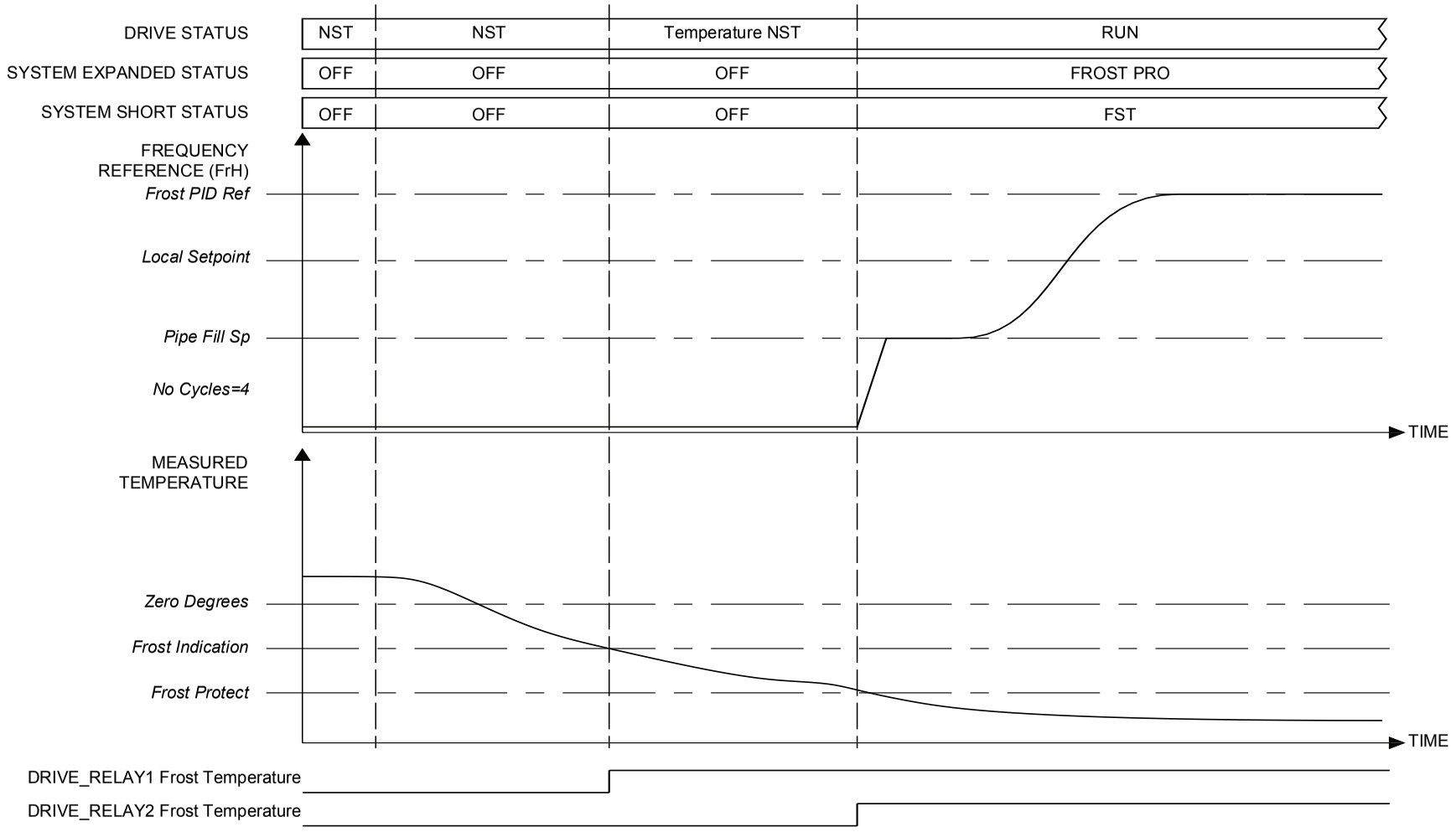
See figure 24, page 82

Parameter Descriptions

Frost Detection

The following diagram describes the frost detection function.

Figure 24



[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [SAVED TIM] ~

[Var Time]: (Var Time)

Default	0
Minimum	0
Maximum	65535
Unit	Hrs or Min
Modbus Address	%mw578

This screen displays the hours the variable speed pump has been running since it was last reset. When displayed, this parameter may be overwritten to reset back to zero or any number desired. If **[Minutes]** is selected in screen **[<EXPANSION>]** ~ **[SAVED TIME]** ~ **[Time Base]**, the value is incremented every minute that the variable speed pump is running.

Note that this parameter is not updated when it is displayed.

[Ext1 Time]: (External Pump One Time)

Default	0
Minimum	0
Maximum	65535
Unit	Hrs or Min
Modbus Address	%mw580

This screen displays the hours external pump one has been running since it was last reset. When displayed, this parameter may be overwritten to reset back to zero or any number desired. If **[Minutes]** is selected in screen **[<EXPANSION>]** ~ **[SAVED TIME]** ~ **[Time Base]**, the value is incremented every minute that external pump one is running.

Note that this parameter is not updated when it is displayed.

[Ext2 Time]: (External Pump Two Time)

Default	0
Minimum	0
Maximum	65535
Unit	Hrs or Min
Modbus Address	%mw582

This screen displays the hours external pump two has been running since it was last reset. When displayed, this parameter may be overwritten to reset back to zero or any number desired. If **[Minutes]** is selected in screen **[<EXPANSION>]** ~ **[SAVED TIME]** ~ **[Time Base]**, the value is incremented every minute that external pump two is running.

Note that this parameter is not updated when it is displayed.

[Ext3 Time]: (External Pump Three Time)

Default	0
Minimum	0
Maximum	65535
Unit	Hrs or Min
Modbus Address	%mw584

This screen displays the hours external pump three has been running since it was last reset. When displayed, this parameter may be overwritten to reset back to zero or any number desired. If **[Minutes]** is selected in screen **[<EXPANSION>]** ~ **[SAVED TIME]** ~ **[Time Base]**, the value is incremented every minute that external pump three is running.

Note that this parameter is not updated when it is displayed.

[Jky Time]: (Jockey Pump Time)

Default	0
Minimum	0
Maximum	65535
Unit	Hrs or Min
Modbus Address	%mw586

This screen displays the hours the jockey pump has been running since it was last reset. When displayed, this parameter may be overwritten to reset back to zero or any number desired. If **[Minutes]** is selected in screen **[<EXPANSION>]** ~ **[SAVED TIME]** ~ **[Time Base]**, the value is incremented every minute that the jockey pump has been running.

Note that this parameter is not updated when it is displayed.

[Time Base]: (Time Base)

Default	**[Hours]**
Range	Hours or Minutes
Modbus Address	%mw588

For commissioning purposes, you can select to have the pump run time hours increment on a per minute basis instead of a per hour basis. This parameter should be reset to **[Hours]** at the completion of commissioning.

Note that if you switch this parameter to from Hours (Minutes) to Minutes (Hours), only the unit changes. The actual run time value is not modified.

[1.14 - WATER SOLUT.] ~ [<EXPANSION>] ~ [CONFIG] ~

[CI_AI51 Type]: (Water Solution, Multi-pump card Analog Input 51)

Default	4-20 mA
Range	4-20 mA or 0-20 mA
Modbus Address	%mw570

This parameter allows you to select the type of transducer being installed.

[CI_AI52 Type]: (Water Solution, Multi-pump card Analog Input 52)

Default	4-20mA
Range	4-20 mA or 0-20 mA
Modbus Address	%mw572

This parameter allows you to select the type of transducer being installed.

[Stop Type]: (Stop Type)

Default	Ramp
Range	Ramp or Wheel
Modbus Address	%mw574

This parameter allows you to select the stop type. For cases where ramp stop is not suitable for the pump being controlled, select Wheel. This causes the motor to stop using the freewheel stop type.

Note that the setting in this screen has priority over **[1.7 APPLICATION FUNCT] [STOP CONFIGURATION] [TYPE OF STOP]**(Stt).

[Fault Ramp]: (Fault Ramp)

Default	3.0
Minimum	0.0
Maximum	999.9
Unit	sec
Modbus Address	%mw576

This parameter sets the ramp rate to be used when a system fault occurs.

[Fault Hist]: (Fault History)

Default	0
Minimum	0
Maximum	8888
Modbus Address	%mw592

This parameter shows a history of system faults in numerical format. A maximum of four digits will be displayed with the left most digit giving the code for the oldest application fault, and the right most digit giving the code for the most recent system fault. The system fault codes are as follows:

1 Flow switch fault.
2 Flow rate fault
3 Analog high pressure fault
4 Cavitation fault
5 Cycle fault
6 Minimum pressure fault
7 Low level fault
8 Digital high pressure fault

For example, if this screen displays 3622, then the last two system faults were flow rate, the system fault immediately prior to these was a minimum pressure fault, and the oldest recorded system fault was an analog high pressure fault. The value in this screen is not write protected, so it may be reset to zero.

[System Units]: (System Units)

Par défaut	0
Minimum	0
Maximum	1
Unit	Metric or imperial
Adresse Modbus	%mw607

This parameter allows you to choose the system units.

If System units = 0: system units used are metric (liter and degree Celcius).
If System units = 1: system units used are imperial (gallon and degree Fahrenheit).

Important: This parameter exists only for software version V1.2 IE03 (**[Version] = 1203**) and higher.

[Version]: (Version)

Minimum	1101
Maximum	9999
Modbus Address	%mw590

This parameter gives the current version of the software application.

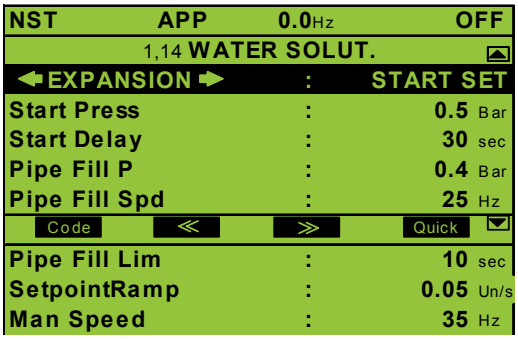
For example, 1101 indicates that the software application is V1.1 IE01.

Configuration Record

The values given in the example column of this table are for a system comprised of a variable speed pump and one external direct on line pump. The system pipe work is rated for a maximum of 6 bars, and the desired constant pressure is 4 bars. The system IO is as shown in the table.

[START SET]

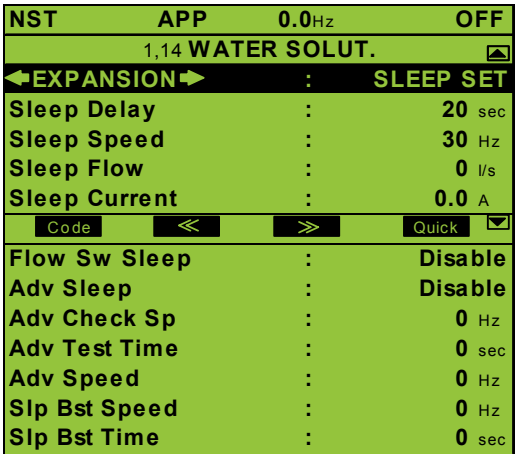
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Start Press]	[Pipe Fill P]	[PID Max Ref]	%MW300	0.5	bar		bar		bar
[Start Delay]	0	999	%MW302	30	sec		sec		sec
[Pipe Fill P]	0	[Start Press]	%MW304	0.4	bar		bar		bar
[Pipe Fill Spd]	LSP	HSP	%MW306	25	Hz		Hz		Hz
[Pipe Fill Lim]	0	32767	%MW308	10	sec		sec		sec
[Setpoint Ramp]	0.01	327.67	%MW310	0.05	Un/s		Un/s		Un/s
[Man Speed]	LSP	HSP	%MW312	35	Hz		Hz		Hz



Configuration Record

[SLEEP SET]

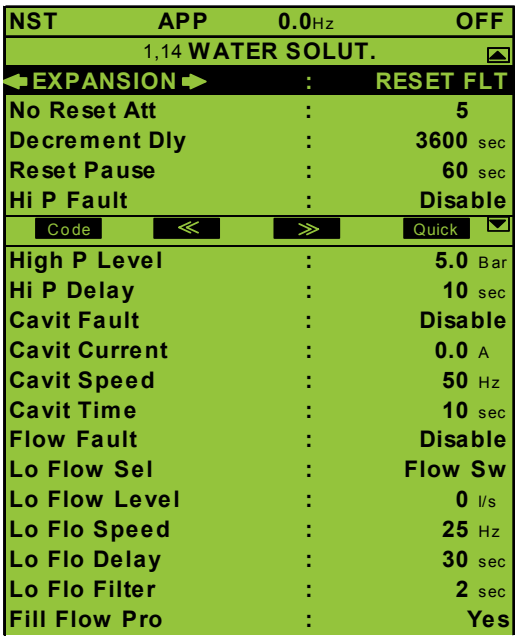
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Sleep Delay]	0	3600	%MW314	20	sec		sec		sec
[Sleep Speed]	LSP	HSP	%MW316	30	Hz		Hz		Hz
[Sleep Flow]	0.00	65535	%MW318	0.00	l/s		l/s		l/s
[Sleep Current]	0.0	3276,7	%MW320	0	A		A		A
[Flow Sw Sleep]	NA	NA	%MW322	[Enable]					
[Adv Sleep]	NA	NA	%MW324	[Enable]					
[Adv Check Sp]	LSP	HSP	%MW326	0	Hz		Hz		Hz
[Adv Test Time]	0	9999	%MW328	0	sec		sec		sec
[Adv Speed]	LSP	HSP	%MW330	0	Hz		Hz		Hz
[Slp Bst Speed]	LSP	HSP	%MW332	0	Hz		Hz		Hz
[Slp Bst Time]	0	250	%MW334	0	sec		sec		sec



Configuration Record

[RESET FLT]

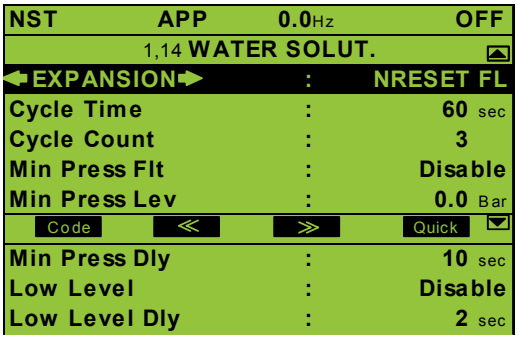
Parameter	Minimum	Maximum	Modbus	Example		Record 1	Record 2	
[No Reset Att]	0	10	%MW336	5				
[Decrement Dly]	0	9999	%MW338	3600	sec	sec		sec
[Reset Pause]	0	9999	%MW340	60	sec	sec		sec
[Hi P Fault]	0	2	%MW342	[Aut Reset]				
[Hi P Level]	0	3276.7	%MW344	5.0	bar	bar		bar
[Hi P Delay]	0	999	%MW346	10	sec	sec		sec
[Cavit Fault]	0	2	%MW348	[Disable]				
[Cavit Current]	0	2*Inv (drive rated current)	%MW350	0.0	A	A		A
[Cavit Speed]	LSP	HSP	%MW352	50	Hz	Hz		Hz
[Cavit Time]	0	999	%MW354	10	sec	sec		sec
[Flow Fault]	0	2	%MW356	[Disable]				
[Lo Flow Sel]	0	2	%MW358	[Flow Sw]				
[Lo Flow Level]	0	327.67	%MW360	0	l/s	l/s		l/s
[Lo Flow Speed]	0	250	%MW362	25	Hz	Hz		Hz
[Lo Flow Delay]	0	999	%MW364	30	sec	sec		sec
[Lo Flow Filter]	0	999	%MW366	2	sec	sec		sec
[Fill Flow Pro]	No	Yes	%MW368	No				



Configuration Record

[NRESET FL]

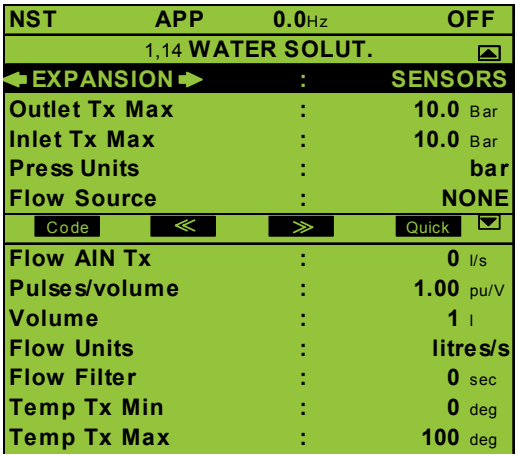
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Cycle Time]	0	3600	%MW370	60	sec		sec		sec
[Cycle Count]	0	99	%MW372	3					
[Min Press Flt]	0	1	%MW374	[Disable]					
[Min Press Lev]	0	32767	%MW376	0.0	bar		bar		bar
[Min Press Dly]	0	3600	%MW378	10	sec		sec		sec
[Low Level]	0	1	%MW380	[Disable]					
[Low Level Dly]	0	3600	%MW382	2	sec		sec		sec



Configuration Record

[SENSORS]

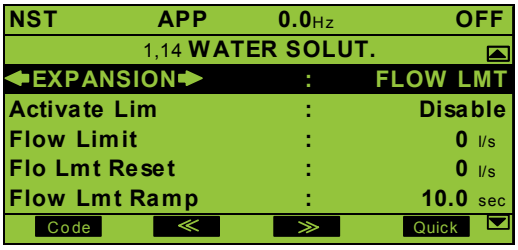
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Outlet TX Max]	1	3276.7	%MW384	10.0	bar		bar		bar
[Inlet TX Max]	1	3276.7	%MW386	10.0	bar		bar		bar
[Press Units]	0	6	%MW388	bar					
[Flow Source]	-	-	%MW390	NONE					
[Flow AIN TX]	0.00	65535	%MW392	0	l/s		l/s		l/s
[Pulses/ Volume]	1	655.35	%MW394	1.00	pu/V		pu/V		pu/V
[Volume]	1	65535	%MW396	1	l		l		l
[Flow Units]	0	6	%MW398	litres/s					
[Flow Filter]	0	65535	%MW400	0	sec		sec		sec
[Temp Tx Min]	-32767	0	%MW402	0	deg		deg		deg
[Temp Tx Max]	0	32767	%MW404	100	deg		deg		deg



Configuration Record

[FLOW LMT]

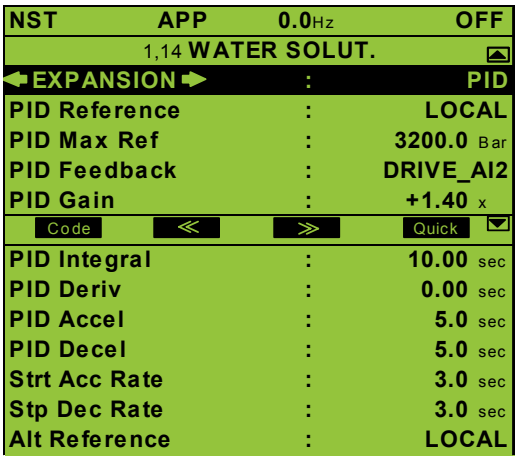
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Activate Lim]	0	1	%MW406	[Disable]					
[Flow Limit]	[Flo Lmt Resest]	32767	%MW408	0	l/s		l/s		l/s
[Flo Lmt Resest]	0.00	[Flow Limit]	%MW410	0	l/s		l/s		l/s
[Flow Lmt Ramp]	0.0	999.9	%MW412	10.0	sec		sec		sec



Configuration Record

[PID]

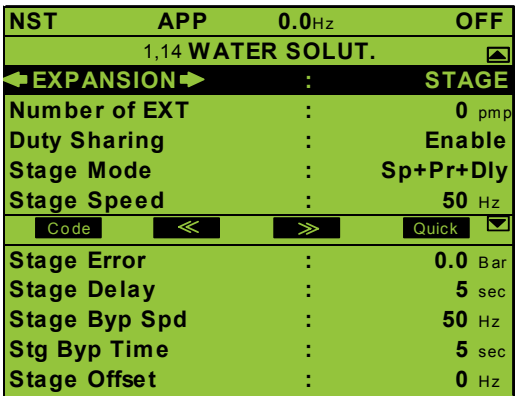
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[PID Reference]	0	6	%MW414	LOCAL					
[PID Max Ref]	0.0	3276.7	%MW416	3200.0	bar		bar		bar
[PID Feedback]	0	5	%MW418	DRIVE_AI2					
[PID Gain]	-100.00	+100.00	%MW420	1,4	X		X		X
[PID Integral]	0.00	100.00	%MW422	10.00	sec		sec		sec
[PID Deriv]	0.00	100.00	%MW424	0.00	sec		sec		sec
[PID Accel]	0.0	999.9	%MW426	5.0	sec		sec		sec
[PID Decel]	0.0	999.9	%MW428	5.0	sec		sec		sec
[Strt Accel Rate]	0.0	999.9	%MW430	3.0	sec		sec		sec
[Stp Dec Rate]	0.0	999.9	%MW432	3.0	sec		sec		sec
[Alt Reference]	0	6	%MW434	LOCAL					



Configuration Record

[STAGE]

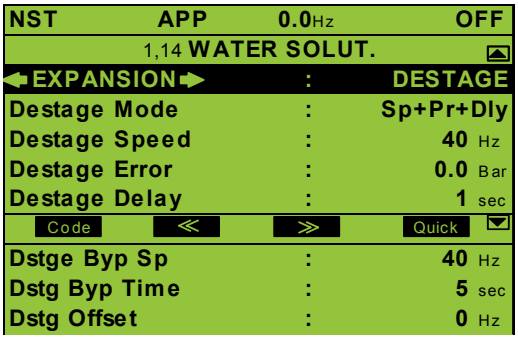
Parameter	Minimum	Maximum	Modbus	Example		Record 1	Record 2	
[Number of EXT]	0	3	%MW436	0	pmp			
[Duty Sharing]	0	1	%MW438	Enable				
[Stage Mode]	0	5	%MW440	Sp+Pr+Dly				
[Stage Speed]	[Stage Byp Spd]	HSP	%MW442	50	Hz		Hz	Hz
[Stage error]	0	3276.7	%MW444	0.0	bar		bar	bar
[Stage Delay]	0	3600	%MW446	5	sec		sec	sec
[Stage Byp Spd]	LSP	[Stage Speed]	%MW448	50	Hz		Hz	Hz
[Stg Byp Time]	0	3600	%MW450	5	sec		sec	sec
[Stage Offset]	0	[Stage Speed] - [Stage Byp Spd]	%MW452	0	Hz		Hz	Hz



Configuration Record

[DESTAGE]

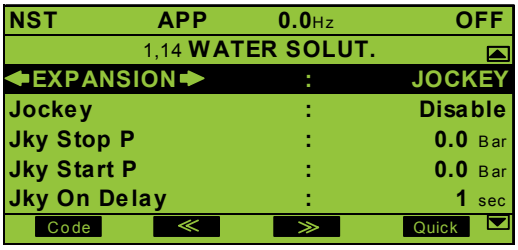
Parameter	Minimum	Maximum	Modbus	Example	Record 1	Record 2	
[Destage Mode]	0	5	%MW454	Sp+Pr+Dly			
[Destage Speed]	**[Dstge Byp Sp]**	HSP	%MW456	40	Hz	Hz	Hz
[Destage Error]	-3276.7	0	%MW458	0.0	bar	bar	bar
[Destage Delay]	1	3600	%MW460	1	sec	sec	sec
[Dstge Byp Sp]	LSP	**[Destage Speed]**	%MW462	40	Hz	Hz	Hz
[Dstg Byp Time]	0	3600	%MW464	5	sec	sec	sec
[Dstg Offset]	0	**[Dstge Byp Sp]** - **[Destage Speed]**	%MW466	0	Hz	Hz	Hz



Configuration Record

[JOCKEY]

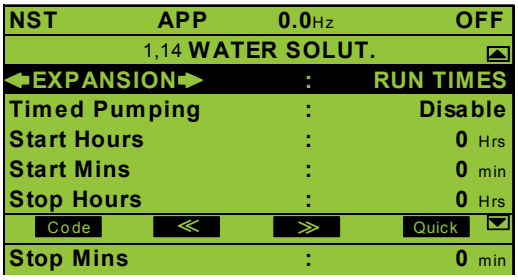
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Jockey]	NA	NA	%MW468	**[Disable]**					
[Jky Stop P]	**[Jky Start P]**	3276,7	%MW470	0.0	bar		bar		bar
[Jky Start P]	0	**[Jky Stop P]**	%MW472	0.0	bar		bar		bar
[Jky On Delay]	0	3600	%MW474	1	sec		sec		sec



Configuration Record

[RUN TIMES]

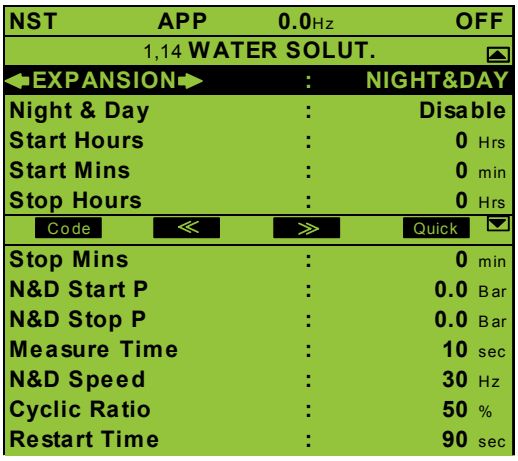
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2
[Timed Pumping]	0	1	%MW476	[Disable]				
[Start Hours]	0	23	%MW478	0	Hrs		Hrs	Hrs
[Start Mins]	0	59	%MW480	0	Min		Min	Min
[Stop Hours]	0	23	%MW482	0	Hrs		Hrs	Hrs
[Stop Mins]	0	59	%MW484	0	Min		Min	Min



Configuration Record

[NIGHT&DAY]

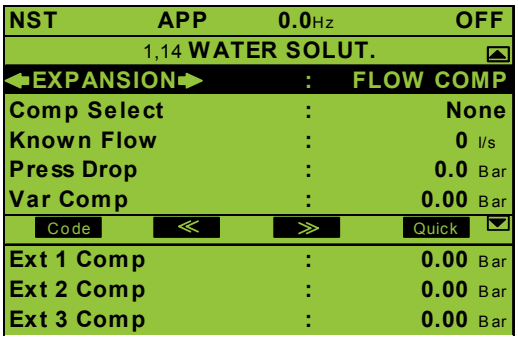
Parameter	Minimum	Maximum	Modbus	Example	Record 1	Record 2	
[Night & Day]	0	1	%MW486	[Disable]			
[Start Hours]	0	23	%MW488	0	Hrs	Hrs	Hrs
[Start Mins]	0	59	%MW490	0	Min	Min	Min
[Stop Hours]	0	23	%MW492	0	Hrs	Hrs	Hrs
[Stop Mins]	0	59	%MW494	0	Min	Min	Min
[N&D Start P]	0	[N&D Stop P]	%MW496	0.0	bar	bar	bar
[N&D Stop P]	[N&D Start P]	3276,7	%MW498	0.0	bar	bar	bar
[Measure Time]	0	32767	%MW500	10	sec	sec	sec
[N&D Speed]	LSP	HSP	%MW502	30	Hz	Hz	Hz
[Cyclic Ratio]	0	32767	%MW504	50	%	%	%
[Restart Time]	0	32767	%MW506	90	sec	sec	sec



Configuration Record

[FLOW COMP]

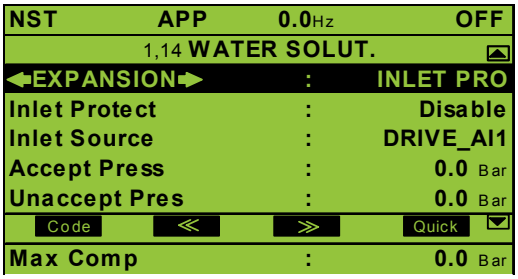
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2
[Comp Select]	0	2	%MW508	[None]				
[Known Flow]	0.00	32767	%MW510	0	l/s		l/s	l/s
[Press Drop]	0.0	3276,7	%MW512	0.0	bar		bar	bar
[Var Comp]	0.00	327,67	%MW514	0.00	bar		bar	bar
[Ext 1 Comp]	0.00	327,67	%MW516	0.00	bar		bar	bar
[Ext 2 Comp]	0.00	327,67	%MW518	0.00	bar		bar	bar
[Ext 3 Comp]	0.00	327,67	%MW520	0.00	bar		bar	bar



Configuration Record

[INLET PRO]

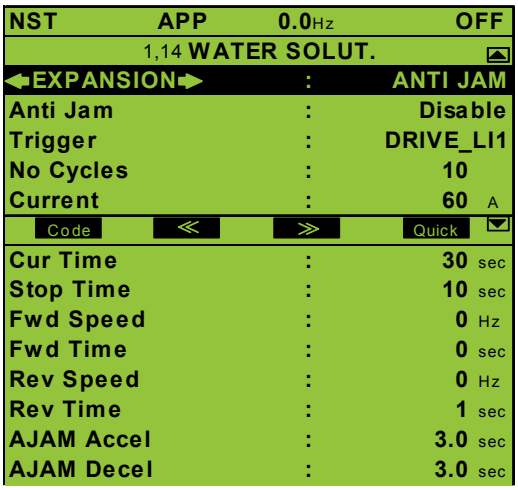
Parameter	Minimum	Maximum	Modbus	Example	Record 1	Record 2	
[Inlet Sensing]	0	1	%MW522	[Disable]			
[Inlet Source]	0	5	%MW524	DRIVE_AI1			
[Accept Press]	[Unaccept Pres]	3276.7	%MW526	0.0	bar	bar	bar
[Unaccept Pres]	0.0	[Accept Press]	%MW528	0.0	bar	bar	bar
[Max Comp]	0.0	3276.7	%MW530	0.0	bar	bar	bar



Configuration Record

[ANTI JAM]

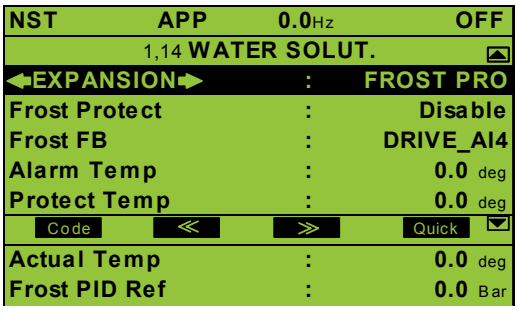
Parameter	Minimum	Maximum	Modbus	Example		Record 1		Record 2	
[Anti Jam]	0	1	%MW534	[Disable]					
[Trigger]	0	2	%MW536	DRIVE_LI1					
[No Cycles]	1	999	%MW538	10	-		-		-
[Current]	0.0	3276.7	%MW540	60	A		A		A
[Cur Time]	1	32767	%MW542	30	sec		sec		sec
[Stop Time]	1	32767	%MW544	10	sec		sec		sec
[Fwd Speed]	LSP	HSP	%MW546	0	Hz		Hz		Hz
[Fwd Time]	0	32767	%MW550	0	sec		sec		sec
[Rev Speed]	-HSP	-LSP	%MW548	0	Hz		Hz		Hz
[Rev Time]	0	32767	%MW552	1	sec		sec		sec
[AJAM Accel]	0.0	999.9	%MW554	3.0	sec		sec		sec
[AJAM Decel]	0.0	999.9	%MW556	3.0	sec		sec		sec



Configuration Record

[FROST PRO]

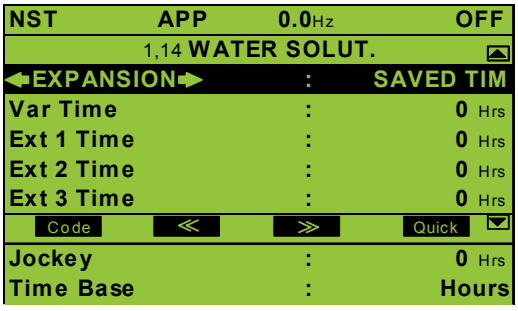
Parameter	Minimum	Maximum	Modbus	Example	Record 1	Record 2	
[Frost Protect]	0	1	%MW558	[Disable]			
[Frost FB]	0	5	%MW560	DRIVE_AI4			
[Alarm Temp]	-3276.7	3276.7	%MW562	0.0	deg	deg	deg
[Protect Temp]	-3276.7	3276.7	%MW564	0.0	deg	deg	deg
[Actual Temp]	-3276.7	3276.7	%MW566	0.0	deg	deg	deg
[Frost PID Ref]	0.0	6553.5	%MW568	0.0	bar	bar	bar



[SAVED TIM]

Parameter	Minimum	Maximum	Modbus	Example	Record 1	Record 2	
[Var Time]	0	65535	%MW578	0	Hrs	Hrs	Hrs
[Ext 1 Time]	0	65535	%MW580	0	Hrs	Hrs	Hrs
[Ext 2 Time]	0	65535	%MW582	0	Hrs	Hrs	Hrs
[Ext 3 Time]	0	65535	%MW584	0	Hrs	Hrs	Hrs
[Jockey]	0	65535	%MW586	0	Hrs	Hrs	Hrs
[Time Base]	NA	NA	%MW588	[Hours]			

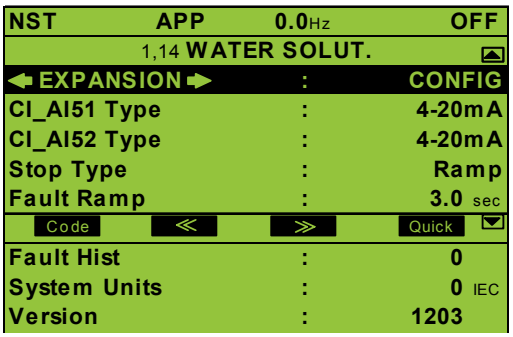
2

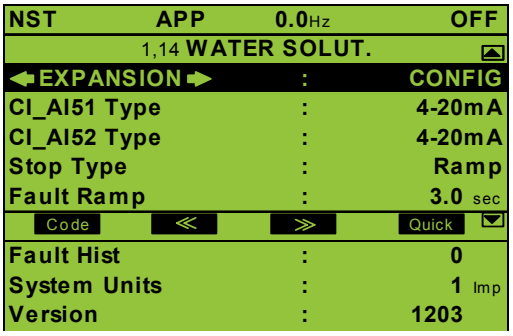


Configuration Record

[CONFIG]

Parameter	Minimum	Maximum	Modbus	Example	Record 1	Record 2	
[CI_AI51 Type]	NA	NA	%MW570	4-20 mA			
[CI_AI52 Type]	NA	NA	%MW572	4-20 mA			
[Stop Type]	NA	NA	%MW574	[Ramp]			
[Fault Ramp]	0.0	999,9	%MW576	3.0	sec	sec	sec
[Fault Hist]	0	8888	%MW592	0			
[System Units]	0	1	%MW607	0/1	IEC/Imp		
[Version]	1101	9999	%MW590	1203			





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